WELFARE SECTION

AFTER a hydrogen bomb attack, thousands would be homeless, hungry, exhausted and frightened. Help and comfort would come from the Welfare Section. Its members are training now for such tasks as evacuation and reception, emergency feeding, and running rest centres, information centres and mobile canteens.

An Emergency Feeding Unit with an improvised hot-plate cooker.

CIVIL DEFENCE CORPS.

10. The Welfare Section are trained to look after the homeless, organise and escort parties of evacuated children. They also run information centres.

Prepared by Dr. William Chipman DCPA

July 13, 1979

(WRITTEN 2 DAYS BEFORE DCPA BECAME FEMA ON 15 JULY 1979)
Dr William Chipman

CIVIL DEFENSE FOR THE 1980's--CURRENT ISSUES

ABSTRACT:

Presidential Decision 41. PD 41 makes it clear that CD is a factor to be taken into account in assessing the strategic balance: The U.S. program is to "enhance deterrence and stability," and to "reduce the possibility that the Soviets could coerce us" in a crisis.

Civil Defense and the Cuban Crisis

There is a final point worth making with respect to civil defense and crises. In a 1978 interview, Steuart L. Pittman, who was Assistant Secretary of Defense for Civil Defense in 1961 to 1964, pointed out:

> [I]t is interesting that President Kennedy personally raised the civil defense question during the Cuban crisis. He was considering conventional military action against Cuba to knock out the missile sites. I understand he was the only one of the "Committee" to raise the issue of civil defense, which tells us something. He asked whether it would be practical to evacuate Miami and other coastal cities in Florida. . . . I was called into the marathon crisis meeting and had to tell him that it would not be practical; we did not have any significant evacuation plans. . . . The President dropped the idea, but shortly after the crisis was over, his personal concern over his limited civil defense options led him to sign a memorandum directing a significant speedup in the U.S. civil defense preparations. (Emphasis added.)93/

While history seldom repeats itself exactly, it does indeed "tell us something" that in the only overt nuclear confrontation the world has

93/*Op. cit. supra* note 73 at 152-153.

yet seen, the American President was concerned about civil defense--and that the idea of population relocation during the crisis was one of his specific concerns. Certainly it is clear that in 1962, the notion of vulnerability being stabilizing held little attraction for the Chief Executive. And as outlined below (in discussion of CD and SALT), the notion that vulnerability is desirable has never commended itself to Soviet leaders.

73/Sullivan, Roger J. et al, The Potential Effects of Crisis Relocation on Crisis Stability, System Planning Corporation, Arlington, Virginia, September 1978.

Richard Titmuss's classic study of civil defence in the Second World War, "Problems of Social Policy", 1950, made the case that the postwar social state originated in the wartime civil defence system to care for millions of bombing evacuees and families who lost their homes.

[See: John Welshman, "Evacuation and Social Policy ... ", Twentieth Century British History (1998) 9 (1): 28-53.]

NUMBER AND CLASSIFICATION OF OFFICIAL EVACUEES IN GREAT BRITAIN IN 1939 AND 1940

900,000 of the 1.5 million returned to the target areas after four months of war.	SEPTEMBER, 1939		JANUARY, 1940	
	Number	Percentage Distribution	Number	Per cent of Those in September, 1939
1. Unaccompanied school children	826,959	56.1	457,600	55
2. Mothers and accompanied children	523,670	35.5	64,900	12
3. Expectant mothers	12,705	0.9	1,140	9
4. Blind persons, cripples, and other special classes	7,057	0.5	2,440	35
5. Teachers and helpers	103,000	7.0	46,500	45
Total	1,473,391	100.0	572,580	39

Source: R. M. Titmuss, *Problems of Social Policy* (London: H.M. Stationery Office, 1950), pp. 103 and 172.

IMPORTANT ANNOUNCEMENT

DISPERSAL OF CIVILIAN POPULATION

....**COUNCIL**

The Government have announced that the voluntary dispersal of the following classes of persons from this area* to reception areas in other parts of the country shall be put into effect immediately.

1. CHILDREN UNDER 15
Children of this age must be taken by their mothers, or by another responsible adult if their mother cannot go. Only in most exceptional circumstances will children be allowed to go on their own. (EXAMPLE : if neither of their parents can go because of illness and there is no one else to take them.)

2. CHILDREN BETWEEN 15 AND 18 STILL AT SCHOOL FULL-TIME
Children in this class may either go with their mothers or on their own. In exceptional circumstances they may go with another responsible adult. (EXAMPLE : a handicapped child whose mother is too ill to go.)

3. CHILDREN BETWEEN 15 AND 18 WHO HAVE LEFT SCHOOL
Children in this class should go on their own. Only in exceptional circumstances may they be accompanied. (EXAMPLE : if they are handicapped, or if the mother is taking younger children.)

4. EXPECTANT MOTHERS

5. BLIND, CRIPPLED OR AGED AND INFIRM PEOPLE *only* if they are dependent on the care of a person who is a member of the classes mentioned above and who is travelling under the scheme.

Special arrangements are being made for the dispersal of children under the age of 18 who are resident at boarding schools, homes or other similar establishments. Parents who do not wish their children to take part in such arrangements should immediately contact the establishments.

Children in the care of a local authority who are living with fosterparents are included in the above classes. If their fosterparents are unable to go with them the Child Care Authority should be informed at once.

Anyone living in the area of..who comes within the above priority classes and wishes to take part in the scheme should go immediately to ....where they will be given further instructions.

CLERK OF THE COUNCIL

***If only part of the area is within the dispersal scheme, the districts affected are shown below:**

UK National Archives: HO 225/54 and CAB 21/4053

HOME OFFICE

SCIENTIFIC ADVISERS' BRANCH

The Circulation of this paper has been strictly limited. Mr Shatt

It is issued for the personal use of ......

SECRET

CD/SA 54

Copy No. 54

Some Aspects of Shelter and Evacuation Policy to meet H-Bomb threat

---

The simplest way of specifying shelter performance is by means of the "Safety Rating" concept developed in CD/SA 48. The safety rating of a shelter was there defined as the saving in life, expressed as a percentage of the deaths without shelter, resulting from the use of the shelter in an area of uniform population density. This shelter with a safety rating of 80 would save 80% of the lives that would have been lost if everyone had been in a house. Put in another way, shelter with a safety rating of 80 would reduce the area within which deaths occurred to one fifth of that for people in houses, and therefore the radius of death to $\frac{1}{\sqrt{5}}$. For a bomb with a power factor of F the equivalent radius of death if everyone is in a shelter with a safety rating of 80 will therefore be $\frac{0.6\sqrt[3]{F}}{\sqrt{5}}$. Similarly for shelter with a safety rating of 90 the radius will be $\frac{0.6\sqrt[3]{F}}{\sqrt{10}}$.

Although, as stated above, the design details of shelters to give these safety ratings have not been determined, it seems probable that surface or trench shelters of rather less than Grade A strength (say 1000 lb/sq.ft.) would be required to give a safety rating of 80, and that a strength of about 2000 lb/sq.ft. would be required for a safety rating of 90. For small street surface shelters the extra cost of an increase in strength of this sort is very small (e.g. the structural cost of a 12"/1000 lb/sq.ft. design is given in CD/SA 48 as £15.2 per person, based on seated capacity) and of a 12"/1400 lb/sq.ft design as £15.5 per person) and detailed studies may well show that shelters with a higher safety rating than 90 are a practical proposition.

(N = 20 kt)

Table 3

Deaths with no evacuation but with everyone in a shelter with a Safety Rating of 90

City	Power of bomb		
	2 Mt	10 Mt	20 Mt
	100N	500N	1000N
London	59,000	216,000	367,000

The considerations discussed above strongly suggest that the right policy against the hydrogen bomb would be to evacuate the central areas of our larger cities and to provide shelter where it is most useful, i.e. in the annulus surrounding the central evacuation area.

CD/SA 48 = Nat. Archives HO 225/48

Table 4

Deaths from 1000N bombs after evacuation of 5 mile radius circle for London and 3 mile radius for other cities. Evacuees assumed accommodated in surrounding annulus where they and the original inhabitants are provided with shelter having a safety rating of 80.

20 Mt

City	Position of bomb		
	Central	2 miles from centre	In position to cause maximum deaths
London	0	0	518,000
Birmingham	0	159,000	256,000
Glasgow	0	171,000	247,000
Liverpool	0	174,000	247,000
Manchester	0	164,000	257,000
Total	0	668,000	1,525,000

Table 5

Deaths from 1000N bombs after evacuation of 5 mile radius circle for London and 3 mile radius for other cities. Evacuees assumed accommodated in surrounding annulus where they and the original inhabitants are provided with shelter with a safety rating of 90.

20 Mt

City	Position of bomb		
	Central	2 miles from centre	In position to cause maximum deaths
London	0	0	261,000
Birmingham	0	56,000	155,000
Glasgow	0	64,000	152,000
Liverpool	0	67,000	152,000
Manchester	0	62,000	151,000
Total	0	249,000	871,000

It will be seen from Tables 4 and 5 that, with this scheme of total evacuation of a central area and shelter in the surrounding annulus, a central bomb causes no deaths at all. Clearly, however, the enemy would be aware of our provisions and might well choose to drop his bombs where they would cause maximum casualties. On average, and without allowing for local concentrations which would be bound to occur in the "reception annulus", this would be at about 7 miles from the centre in the case of London and about 4 miles for the other cities. The average deaths from bombs in these worst positions are therefore given in Tables 4 and 5. Comparing these figures with those to Table 1 it will be seen that evacuation plus shelter with a safety rating of 80 has reduced deaths by 82%, and plus shelter with a safety rating of 90 by 90%.

Conclusion

Without shelter or evacuation, the deaths from an attack with only five hydrogen bombs might total over $8\frac{1}{2}$ million. The primary object of Civil Defence must be to reduce this figure. Neither evacuation alone nor shelter alone could reduce these deaths to a manageable proportion, but with a suitable combination of the two, consisting of the total evacuation of the population of the central areas into the surrounding annuli where shelter would be provided, it should be possible to reduce the maximum deaths from this particular attack to something of the order of one million.

April, 1954.

E.L.W. **E. L. W. = Edward Leader-Williams**

OSA.41/4/32. **(who in WWII tested the Morrison shelter while John Fleetwood Baker's colleague)**

REFERENCES:

CD/SA 48 = Nat. Archives HO 225/48, "The safety-cost relationship for certain types of surface and trench shelters"

CD/SA 72 = Nat. Archives HO 225/72, "Casualty estimates for ground burst 10 megaton bombs"

JOINT SERVICE MANUAL
OF
HOME DEFENCE

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CHAPTER INDEX

PART I - BACKGROUND TO HOME DEFENCE

CHAPTER 1

INTRODUCTION TO HOME DEFENCE

"The phoenix of mythology re-juvenated itself in flames, rising from its own ashes to a new life. The flames of a future war may, or may not be of our own creating and, in a nuclear conflict, will certainly be more than a little hot. The ultimate purpose of Home Defence is to ensure that we are able to rise phoenix-like from the ashes of a nuclear conflagration and that any lack of preparation does not result in the death of the bird - our nation."

SECTION 1. INTRODUCTION

NCE ACT 1948

FORMS OF ATTACK

123. The current assessments point clearly to nuclear was as the overriding consideration in determining the preparations to be made for home defence in the United Kingdom. Whilst it is possible that chemical weapons and, to a lesser extent biological warfare, could be used against selected vitally important civil and military installations, their use against the civil population as a whole is considered most unlikely. The use of aircraft and missiles armed with non-nuclear devices against selected targets cannot be discounted, but most of the measures taken in the context of a nuclear war would be of equal relevance to a war which began with conventional weapons.

EFFECTS OF ATTACK

124. As with the warning period, the scale and pattern of attack cannot be determined with precision but, whatever the scale, an attack by thermo-nuclear weapons directed against civil and military installati[ons] and against centres of population, with the attendant threat of widespre[ad] radioactive fall-out, would result in enormous casualties and extensive damage. Although estimates can be made of local casualties and of damage caused by varying attack patterns, no probability can be given to any one group of attack patterns. Nevertheless, solely for the purpose of survival planning, it can be assumed that the population survival rate would range from 60% in the worst affected areas to 95% in the least affected areas. On the other hand, loss of essential services and productive capacity due to installation damage, loss of power supplies and lack of raw materials, could be as high as 80%. These figures are merely indicative of the possible scale of the effe[cts] of nuclear war.

SECTION 1. INTRODUCTION

201. This chapter is not intended to be a comprehensive assessment of the threat to the United Kingdom. It merely sets the scene within which the subject of Home Defence can be studied. Those requiring a greater depth of knowledge must turn to available classified publicati A basic knowledge of the effects of nuclear explosions is assumed and can be obtained from pamphlets listed in the Bibliography (Annex C to the Manual).

202. The overall threat can be divided into the following:

a. Internal Threat - sabotage and subversion.

b. Conventional attack.

c. Nuclear attack.

d. Chemical attack.

e. Biological attack.

03. Current assessments point clearly to nuclear attack as th verriding consideration in determining the preparations to be ma or Home Defence in the United Kingdom and this must be accepted basic planning assumption. Planning to deal with the other f

targets but also ... will and ...
weaken the national will and ...

208. One result of sabotage would be to tie down la
men on static guard duties thereby preventing them fro
other necessary tasks.

SUBVERSION

209. There exist in this country certain dissider
which are known to be in sympathy with our potential
can be expected to react against the good of the nat
tension. These groups are small and for the most p
influence. Moreover, it is likely that their numbe
enemy were seen to be about to attack us. However
especially that of the IRA, should not be underesti

210. The threat posed by subversive groups inclu
in key industries, promoting anti-war demonstration
against the Government and disruptive activities co
preparations.

SECTION 6 - INFORMATION TO THE PUBLIC IN WAR

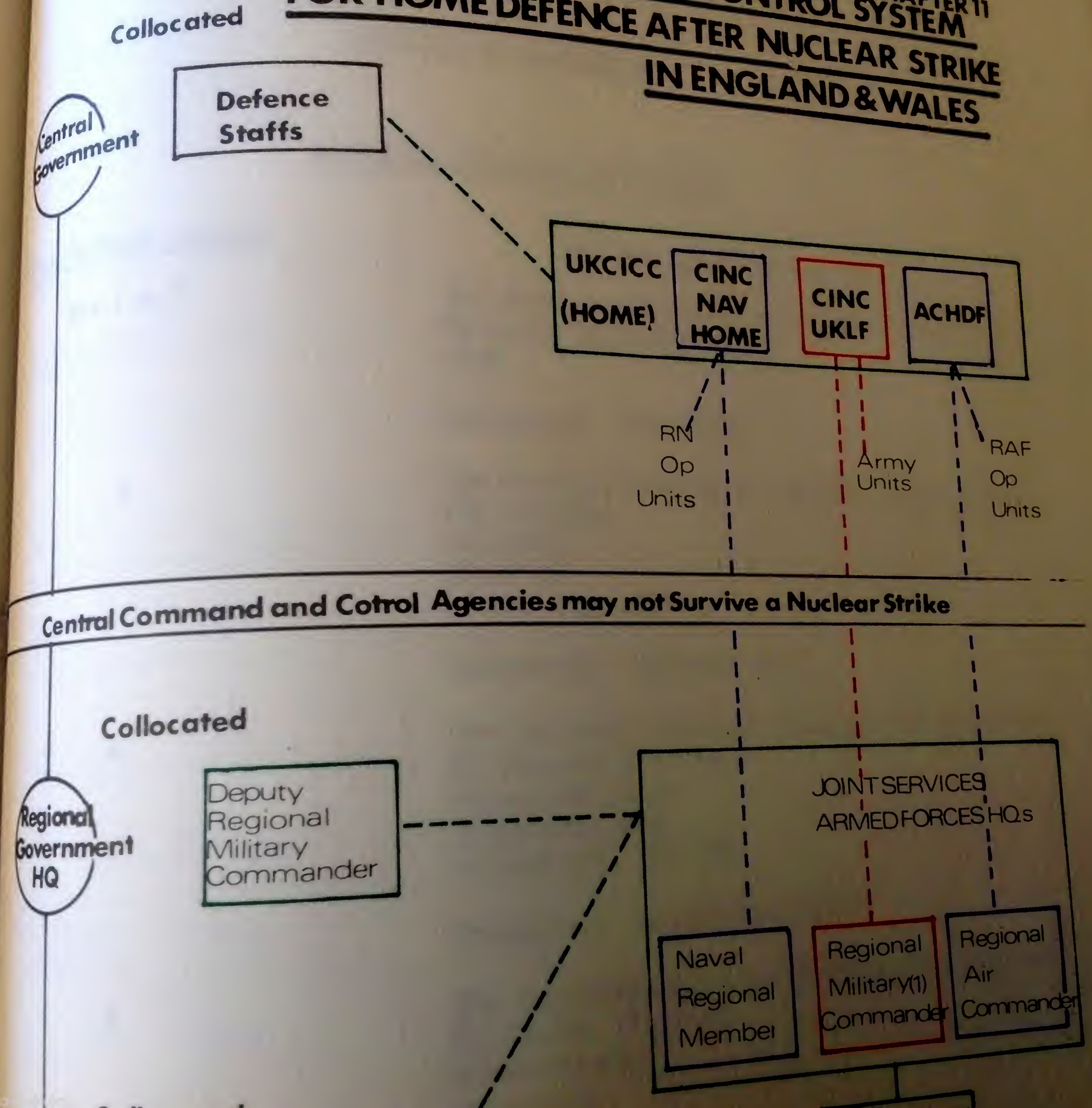
INTRODUCTION

1056. The question of what the public should be told and when is an extremely difficult one. Certain announcements can be prepared for issue in a period of tension and post strike. The timing of their issue cannot, however, be accurately pre-planned and will largely be a matter for decision in the event.

1057. The two conflicting issues in retaining the full cooperation of the public are firstly to avoid any sort of panic possibly leading to a mass movement of population and secondly to ensure that sufficient warning is given to allow necessary preventative and later survival action to be taken.

ANNEX B TO CHAPTER 11

JOINT SERVICE COMMAND & CONTROL SYSTEM FOR HOME DEFENCE AFTER NUCLEAR STRIKE IN ENGLAND & WALES



JIC(68) 4 (Final)

22nd January, 1968.

EMPLOYMENT OF SOVIET FORCES IN THE EVENT OF GENERAL WAR UP TO THE END OF 1972

Report by the Joint Intelligence Committee

INTRODUCTION

The likelihood of war with the Soviet Union and the ways by which it might come about are examined in our reports JIC(65) 87 (Final) and JIC(66) 77 (Revised Final) in which we concluded that "the Soviet leaders will not deliberately start a general war and are most unlikely deliberately to start a limited war". We also concluded that war between the Soviet Union and the West could result from miscalculation, but that this was unlikely. Notwithstanding these assessments there is a requirement to provide views on how the Soviet armed forces might be employed in the event of general war.

2. In examining this problem we assume that a critical situation in some part of the world has given rise to a period of mounting tension between the Soviet Union and the West; and that as a result of a process of miscalculation the Soviet Union decides on all-out war, including a full-scale strategic nuclear attack. Probable plans for the employment of Soviet armed forces in this latter circumstance are discussed below.

3. We believe that the overriding Soviet aim in general war would be to limit damage to the Soviet Union to the greatest extent possible. With this in mind, their military objectives are likely to be -

(a) Primary Objective
To destroy as much as possible of the Western strategic offensive capability and the Western will to fight;

(b) Secondary Objective
To engage and defeat such other Western military forces as remained, in order subsequently to extract any possible advantage for the Soviet Union.

8. It would seem logical therefore for the Russians to conclude that, having covered those nuclear strike force and air defence targets which are susceptible to attack, the most profitable targets in the United States would be those related to the aim of destroying the will and ability of the government and people to continue the war. These would include centres of governmental and military control and concentrations of industry and population.

9. In Europe, all worthwhile targets in NATO countries, including the United Kingdom, can be covered by the large MRBM/IRBM and medium bomber forces located in Western Russia.

WEAPONS SYSTEMS

ICBMs

10. ICBMs would be used against targets in North America; they have the advantage of giving a shorter warning time than aircraft and are suitable for the engagement of static targets. In addition to the systems now being deployed, there are several development projects under way which could result in operational systems during the period. A Fractional Orbit Bombardment System (FOBS) has been undergoing regular research and development testing and may be deployed as an operational system. If so it would add to the diversity of Russia's strategic threat, reduce warning times and make target prediction more difficult. A solid propellant ICBM is also believed to be under development, and mobile ICBM concepts are being investigated by the Russians. If deployed the mobile systems would supplement systems in permanent sites; solid propellant ICBMs might be deployed in new sites or installed as replacement missiles at existing sites.

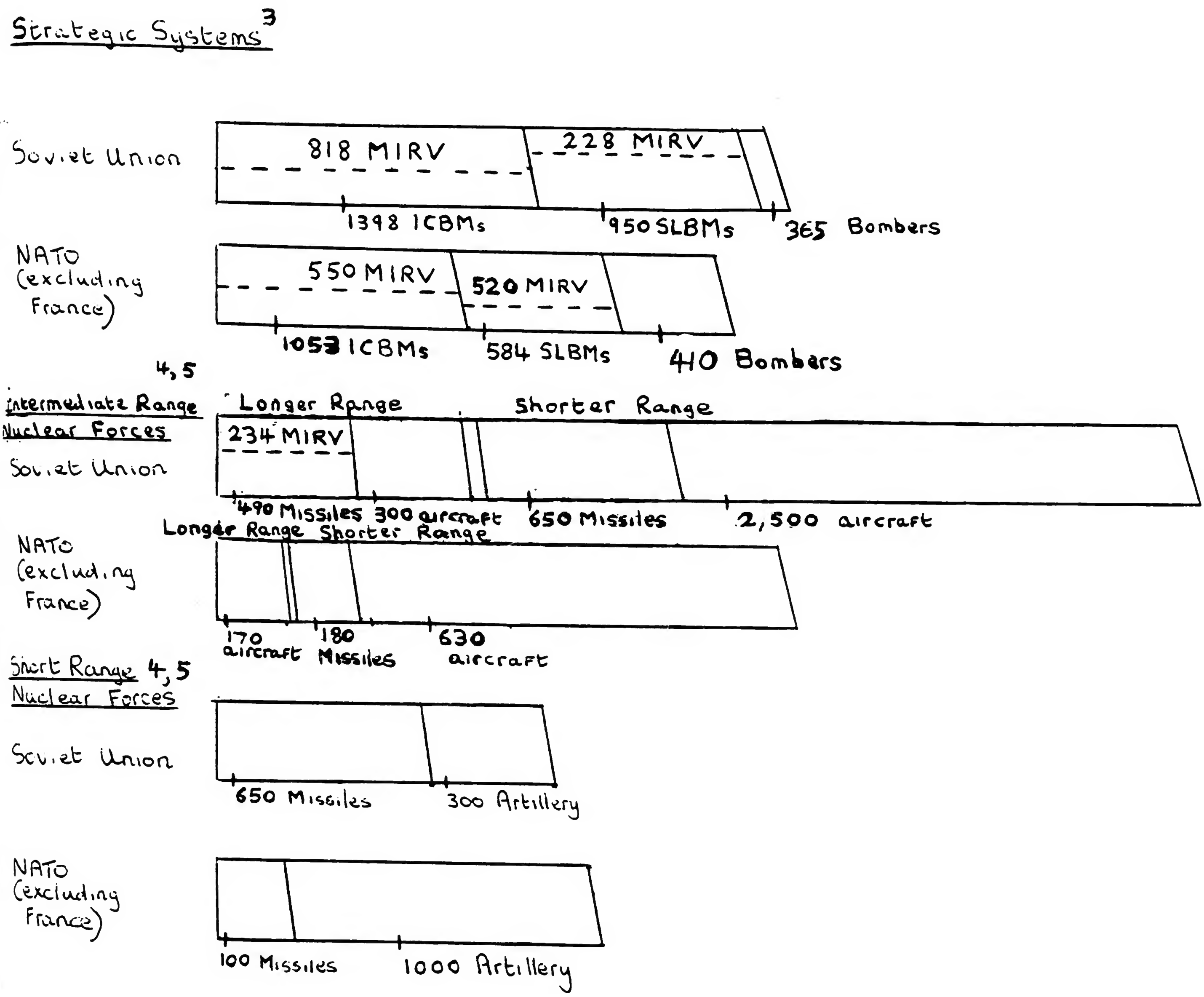
MRBM/IRBMs

11. MRBM/IRBMs have sufficient accuracy and warhead yield, together with short warning time, to be suitable for use against Western nuclear strike forces in Europe all of which are at present unhardened. They are also suitable for use against major cities, industrial targets and centres of control.

12. MRBMs would normally be launched from permanent sites. However, the Russians have constructed a large number of "field" type launch positions in the vicinity of permanent soft MRBM sites. These "field" sites are believed to have no permanent facilities but to consist of

CONFIDENTIAL

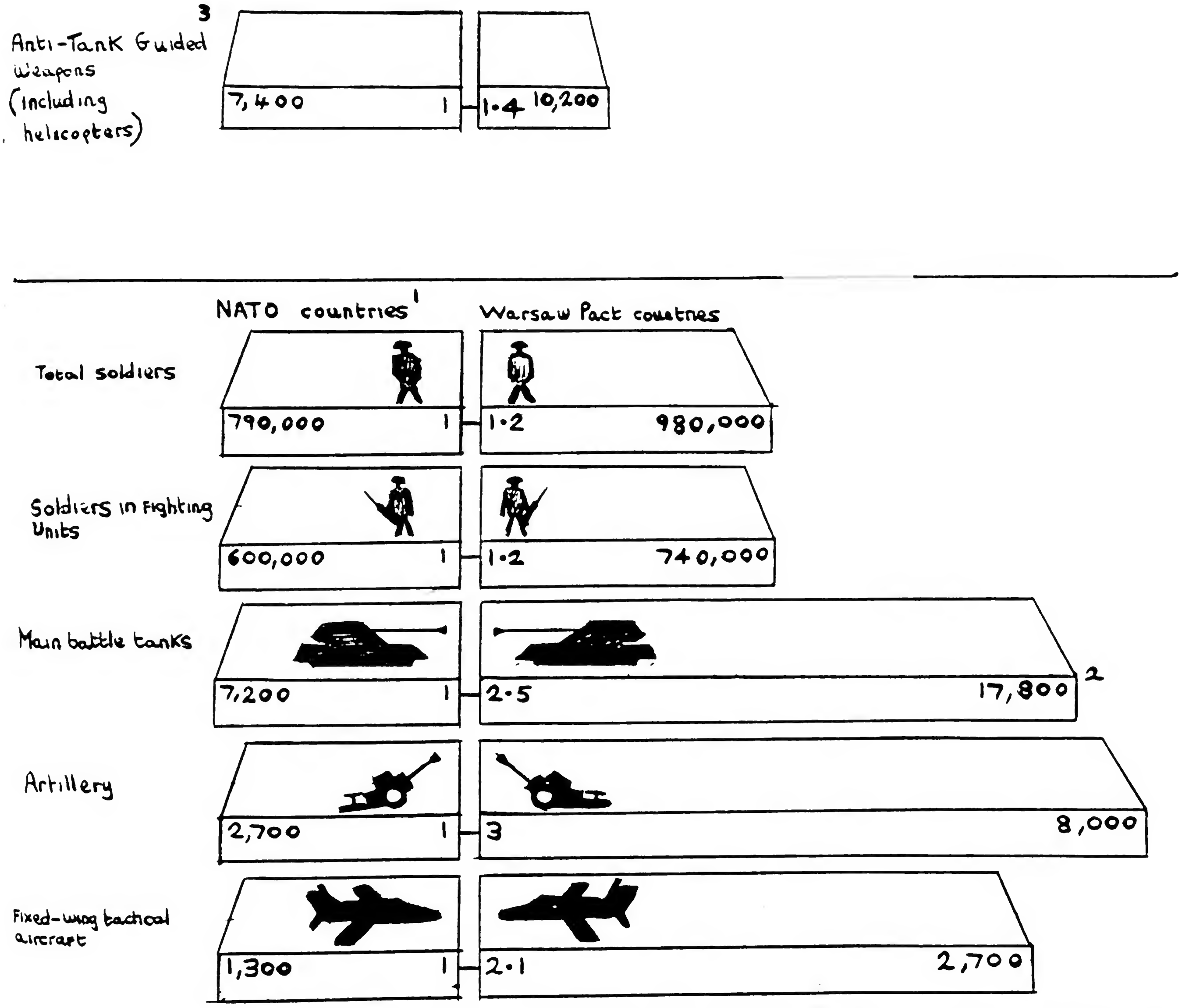
Figure 3 The Balance of Nuclear Forces End-1982[1,2]



CONFIDENTIAL

Figure 4

The Current Balance of Forces on the Central Front



1 Including French forces in the Federal Republic of Germany but excluding the Berlin garrison, which is not declared to NATO

2 Includes some Warsaw Pact tanks in training units and storage which would be available for operational use

3 Weapons which are, or have the capability of being, vehicle or helicopter mounted.

CIVIL DEFENCE
INSTRUCTORS' NOTES

Welfare Section

Part III

Evacuation and Care of the Homeless

CIVIL CD DEFENCE

PUBLISHED FOR THE HOME OFFICE
AND MINISTRY OF HOUSING AND LOCAL GOVERNMENT
BY HER MAJESTY'S STATIONERY OFFICE

HOME OFFICE

MINISTRY OF HOUSING AND LOCAL GOVERNMENT

(published in August 1960)

Civil Defence Instructors' Notes

WELFARE SECTION

PART III

DISPERSAL

~~Evacuation~~ and Care of the Homeless

(NOTE: contrary to propaganda from CND, New Statesman's Duncan Campbell, and the USSR's "World Peace Council", civil defence evacuation in Britain helped to deter a Nazi "knockout blow" air raid: BEFORE we declared war on 3 September 1939 we evacuated children from London in "Operation Pied Piper". This is hard fact.)

LONDON

HER MAJESTY'S STATIONERY OFFICE

1960

PRICE 2s. 6d. NET

BILLETING SURVEY FORM

District .... Ward or Parish ....

1 Address ....

....

2 Name of Householder ....

3 Number of habitable rooms ....

		Adult	Children (age)	
4 Number of persons ordinarily resident	Male	....	....	....
	Female	....	....	....

5 Is the house suitable for (*a*) Unaccompanied children ....

(*b*) Aged-infirm ....

(*c*) Handicapped ....

(*d*) Expectant mothers ....

6 Is the householder willing to take unaccompanied children? ....

7 Has the householder any spare beds, bedding, or other equipment? ....

8 Any other comments (e.g. old age or infirmity of householder, etc.) ....

....

....

....

....

....

Date of visit .... Signature of visitor ....

REGISTRATION OF PRIORITY CLASS EVACUEES

PLACE OF REGISTRATION ....

SHEET No. ....

COUNCIL ....

	Train Parties						
	Family Groups (including Adolescents)				Unaccompanied Children		
	Surname	Adults	Children	Total	Surname	Total Over 5	Total Under 5
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							

REGISTRATION OF PRIORITY CLASS EVACUEES

PLACE OF REGISTRATION ....

SHEET No. ....

COUNCIL ....

Special Transport		
Surname Mr. Mrs. Miss	Address	Reason for Special Transport

HOMELESS PERSONS

PRELIMINARY REGISTRATION

(To be made as early as possible)

Date..

PLACE OF REGISTRATION.. SHEET NO...............................

	Surname of Family	Adults		Children Under 15	Home Address	Other Information
		Male	Female			
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						

REST CENTRE REGISTER

Date ....

NAME OF REST CENTRE.. COUNCIL.. SHEET NO...............................

	SURNAME	CHRISTIAN NAME(S)	SEX	HOME ADDRESS	ADDRESS WHENCE ADMITTED (IF DIFFERENT)	DATE OF DEPARTURE	DESTINATION (X IF OFFICIALLY BILLETED)	OTHER INFORMATION
1	2	3	4	5	6	7	8	9
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								

CLOTHING EMERGENCY ISSUE FORM

Place of Issue..

Date..

Name ....

Address..

....

....

Number served in family..

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
MEN'S	*Over-coats*	*Trousers*	*Jerseys*	*Jackets*	*Shirts*	*Vests*	*Pants*	*Socks*	*Night-wear*	*Dressing Gowns*	*Boots Shoes*	*Welling-tons*	*Mackin-toshes*	*Braces Belts*	*Suits Battledress*	*Unclassified*
WOMEN'S	*Over-coats*	*Skirts*	*Jerseys Jackets*	*Dresses*	*Blouses*	*Vests*	*Knickers*	*Stock-ings*	*Night-wear*	*Dressing Gowns*	*Shoes*	*Welling-tons*	*Mackin-toshes*	*Belts Corsets*	*Costumes Battledress*	*Unclassified*
BOYS'	*Over-coats*	*Shorts*	*Jerseys*	*Jackets*	*Shirts*	*Vests*	*Pants*	*Socks*	*Night-wear*	*Dressing Gowns*	*Boots Shoes*	*Welling-tons*	*Mackin-toshes*	*Braces Belts*	*Suits Battledress*	*Unclassified*
GIRLS'	*Over-coats*	*Skirts*	*Jerseys*	*Dresses*	*Blouses*	*Vests*	*Knickers*	*Stock-ings*	*Night-wear*	*Dressing Gowns*	*Shoes*	*Welling-tons*	*Mackin-toshes*	*Belts*	*Costumes Battledress*	*Unclassified*
UNDER 4's	*Coats*	*Shorts Skirts*	*Jerseys*	*Suits Dresses*	*Shirts Blouses*	*Vests*	*Pants Pilches*	*Socks*	*Night-wear*	*Dressing Gowns*	*Shoes*	*Welling-tons*	*Mackin-toshes*	*Bodices*	*Nappies*	*Layettes*

Signature of Recipient..

Signature of Member Issuing..

CLOTHING REQUEST FORM

No.:..

To..Supply Depot

From (Place)..

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	
MEN'S	*Over-coats*	*Trousers*	*Jerseys*	*Jackets*	*Shirts*	*Vests*	*Pants*	*Socks*	*Night Wear*	*Dressing Gowns*	*Boots Shoes*	*Welling-tons*	*Mackin-toshes*	*Braces Belts*	*Suits Battle-dress*	*Unclassified*	*Remarks*
Requested																	
Sent																	
WOMEN'S	*Over-coats*	*Skirts*	*Jerseys Jackets*	*Dresses*	*Blouses*	*Vests*	*Knickers*	*Stock-ings*	*Night Wear*	*Dressing Gowns*	*Shoes*	*Welling-tons*	*Mackin-toshes*	*Belts Corsets*	*Costumes Battle-dress*	*Unclassified*	*Remarks*
Requested																	
Sent																	
BOYS'	*Over-coats*	*Shorts*	*Jerseys*	*Jackets*	*Shirts*	*Vests*	*Pants*	*Socks*	*Night Wear*	*Dressing Gowns*	*Boots Shoes*	*Welling-tons*	*Mackin-toshes*	*Braces Belts*	*Suits Battle-dress*	*Unclassified*	*Remarks*
Requested																	
Sent																	
GIRLS'	*Over-coats*	*Skirts*	*Jerseys Jackets*	*Dresses*	*Blouses*	*Vests*	*Knickers*	*Stock-ings*	*Night Wear*	*Dressing Gowns*	*Shoes*	*Welling-tons*	*Mackin-toshes*	*Belts*	*Costumes Battle-dress*	*Unclassified*	*Remarks*
Requested																	
Sent																	
UNDER 4's.	*Coats*	*Shorts Skirts*	*Jerseys*	*Suits Dresses*	*Shirts Blouses*	*Vests*	*Pants Pilches*	*Socks*	*Night Wear*	*Dressing Gowns*	*Shoes*	*Welling-tons*	*Mackin-toshes*	*Bodices*	*Nappies*	*Layettes*	*Remarks*
Requested																	
Sent																	

Signature of member requesting.. Date.....................................

Signature of member sending clothing.. Date.....................................

Two copies to be sent to SUPPLY DEPOT which keeps one copy, and RETURNS the other with the clothing.

CLOTHING STOCK RETURN

PAGE..............................

	Date	A Over-coats	B Trousers Skirts	C Jerseys *Jackets	D Jackets Dresses	E Shirts Blouses	F Vests	G Pants Knickers	H Socks Stock-ings	I Night wear	J Dressing Gowns	K Boots Shoes	L Welling-tons	M Mackin-toshes	N Braces Belts Corsets	O Suits Costumes Battle-dress	P Unclassified
MEN'S Stock																	
Further stock received																	
Total																	
Total on stocktaking																	
Garments requested																	
WOMEN'S Stock																	
Further stock received																	
Total																	
Total on stocktaking																	
Garments requested																	
BOYS' Stock																	
Further stock received																	
Total																	
Total on stocktaking																	
Garments requested																	
GIRLS' Stock																	
Further stock received																	
Total																	
Total on stocktaking																	
Garments requested																	
UNDER 4's.		Coats	Shorts Skirts	Jerseys	Suits Dresses	Shirts Blouses	Vests	Pants Pilches	Socks	Night wear	Dressing gowns	Shoes	Welling-tons	Mackin-toshes	Bodices	Nappies	Layettes
Stock																	
Further stock received																	
Total																	
Total on stocktaking																	
Garments requested																	

* For women and girls.

(After stocktaking, start a new page, and carry forward " Total on stocktaking ")

THE PURPOSE OF ~~EVACUATION AND~~ CARE OF THE HOMELESS

A. Aims

1 *Care of the Homeless:* The provision of shelter and practical help for those who lose their homes or have to leave them because of enemy action.

~~2 *Evacuation:* To disperse part of the population before an attack, with the object of saving life.~~

B. Plans

3 *Care of the Homeless:* Plans for the temporary accommodation of the homeless are based on the use of existing buildings as rest centres in which the homeless can be lodged temporarily until they can be found more permanent accommodation in billets or requisitioned houses. The responsibility for providing rest centres lies with county and county borough councils who are responsible for the ordinary peace time welfare services. The responsibility for billeting and otherwise housing the homeless rests with county borough and county district councils who are the housing authorities in peace time. The decision to open rest centres in war would rest with the appropriate civil defence controller. County councils may delegate the day to day administration of the rest centre service to county district councils, in which case there will be a need for close liaison between the district council officer in charge locally and the chief rest centre officer of the county. The Ministry of Housing and Local Government is the Department responsible for rest centre service policy.

~~4 *Evacuation:* Evacuation policy is the responsibility of the Ministry of Housing and Local Government. It would be the responsibility of the Government as a whole to decide whether to put any previously prepared evacuation scheme into operation on the threat of war. They would have to consider whether there was time to complete the operation before war broke out.~~

~~Evacuation, like other defence planning, has to take account of the latest assessments of the type of attack that might be launched and the means of defence against it. At the present time the Government are reconsidering the proposals for the evacuation of 12 million members of the priority classes, which were announced in 1956. It may be assumed however that any future evacuation plans will have the following basic features:~~

~~(*a*) The country will be divided into evacuation, neutral and reception areas.~~

~~(*b*) Evacuation areas will be linked as far as possible with specific reception areas.~~

~~(*c*) The main movement will be by rail.~~

~~(*d*) There will be priority classes (e.g., women, children, the aged and infirm, blind, crippled, etc.).~~

~~(*e*) The scheme will be voluntary.~~

~~(*f*) The details of running it will be the responsibility of the following local authorities:~~

~~(i) In *evacuation* areas the county boroughs and county district councils will be responsible for assembling those to be evacuated and seeing that they are entrained (special arrangements will be made for the London area, under which the L.C.C. will be responsible).~~

~~(ii) In *reception* areas county councils will be responsible for the reception of evacuees at detraining points and for their onward transport to their reception areas. County district councils (and county boroughs) will be responsible for the local reception of evacuees, their billeting and their general welfare thereafter.~~

REST ~~AND RECEPTION~~ CENTRES

Rest Centres

2 (*a*) *Definition*

A building used for the temporary accommodation of homeless persons until such time as they can return to their homes or be billeted or otherwise rehoused.

(*b*) *Types of Rest Centres*

(i) *Planned Centres:* Those earmarked in advance. Some may be large buildings with good facilities (e.g. schools) and a certain amount of equipment immediately available. There may be an emergency meals centre in the same building.

MOVEMENT

Unplanned movement of homeless from a damaged area

4 (*a*) Despite exhortations to " stay put " under cover after a nuclear attack, there will inevitably be a number, perhaps a very large number, of people who will seek to escape from the damaged areas; others will be driven from their homes by fire or by the destruction of effective cover. The control of this movement of the homeless will be largely a matter for the police and wardens, aided by street leaders, whose aim will be (1) to get the homeless under cover in any available accommodation and (2) to keep them away from the essential services routes.

(*b*) It is likely that in damaged areas no trained help may be available from the Welfare Section, e.g., in temporary refuges where homeless have been directed in order to get them under cover quickly. In such cases reliance must be on self-help; the only amenities will be those which are to be found in the refuge or which are brought in by the occupants. Where it is possible for Welfare Section members to get to refuges where a number of homeless are known to have congregated they should do so and give what help they can under the existing circumstances. The most important problems are likely to be those connected with first aid, sanitation and water.

Movement from fall-out areas

5 (*a*) After nuclear attack, it may be necessary to evacuate everyone from areas in which radioactivity from fall-out exceeds a certain intensity. Such a movement will not be possible until about 48 hours after the attack, and it will then be carried out on instructions from the control organisation.

(*b*) Welfare Section members will be concerned with the arrangements for the reception of persons evacuated from such areas. The procedure to be followed will be similar to that for other homeless persons. Initially they will be accommodated in rest centres; later, as far as circumstances permit, they will be billeted. It must be remembered that the incidence of radiation sickness among persons evacuated from areas of intense radioactivity is likely to be high.

Notes on teaching WE 8

6 Reference may be made to the Manual of Civil Defence, Volume I, Pamphlet No. 2 " Radioactive Fall-out Provisional Scheme of Public Control " and to WE/WF 34 " Control of the Public in Radioactive Zones ". (See also Note WE/WF 3, Part II.)

7 Throughout this session emphasis should be on the need for speed because:

~~(a) Any delay in the evacuation movement might mean that thousands of people would remain at risk who might otherwise have been moved.~~

(*b*) In view of the danger of radioactive fall-out it is essential that homeless should be got under cover without delay; shelter in a damaged building is better than remaining in the open.

ARRANGEMENTS FOR MEDICAL CARE

Introduction

1 In time of war the number of doctors and trained nurses available would inevitably fall far short of the need. It follows therefore that many injuries and illnesses, where normally skilled medical aid would be sought, will have to be dealt with by untrained or semi-trained helpers. A great deal of this work will fall to the lot of members of the Welfare Section and it is essential that all volunteers should acquire as much experience as possible in Home Nursing and First Aid. As far as possible families should be kept together and should tend each other.

Rest Centres

2 Rest centres will be working under conditions of great stress but must have space set aside for homeless persons requiring nursing care or first aid. The proportion of the accommodation of a rest centre which will be needed at any one time for this purpose will vary initially according to the location of the centre, and later, to the demands placed upon it.

In rest centres near the area of damage, it is likely that a large number of the homeless will need early treatment in some form or other. In addition if a Forward Medical Aid Unit is working in the vicinity some of the less seriously injured and psychiatric casualties who have passed through and have been discharged by the Unit will be homeless and may need further care at the rest centre.

The length of time the casualties will have to remain in the rest centres will depend on circumstances but in some instances it may have to be for a considerable time. Help in caring for casualties should be obtained from members of the patient's family or able-bodied homeless with particular skill and experience. When circumstances permit, advice and some assistance may be available to the rest centre staff from general practitioners and local authority nurses in the area.

Clearance from Z Zones *

3 Persons cleared from Z Zones will normally be brought to rest centres and the procedure for meeting their immediate needs and for billeting will be as for any other homeless. It must be remembered, however, that among those brought out from the Z Zone some will have received a large dose of radiation and may be expected to develop radiation sickness. Cases of radiation sickness will not normally be admitted to hospital since treatment consists mainly of rest and quiet and hospital beds will be needed for more urgent cases. There are several phases in the illness, and the nature, and scope of the provision which will have to be made will depend to some extent on the time which has elapsed since the radiation dose was received. The vomiting and diarrhoea are distressing and unpleasant, and it may be desirable to set aside special centres for treating cases of the sickness. Nursing could be on a rota system, shared by members of the Welfare Section and others willing and able to help.

* Z Zones are defined as areas above 10 R/hr (10 cGy/hr) of gamma at 48 hrs after burst.

WELFARE IN BILLETS

Main headings

1 Immediate and long term welfare; visiting and supervision of billets; problems of shared homes; unaccompanied children; special groups.

Immediate welfare

2 Initial billeting would have to be carried out at speed and under great pressure. Immediate welfare would consist simply of seeing that evacuees had a roof over their heads and enough food for their needs.

Long term welfare

3 This is an entirely different problem. If a heavy attack on this country followed closely on evacuation, the life-saving aspect of the scheme would be appreciated; people would be ready to accept the extreme discomfort involved and would realise that only help with major difficulties would be possible. If, however, there were no immediate attack, or if a large part of the country were unaffected, many individual difficulties would be brought forward which in an extreme crisis might have been accepted. The Welfare Section will have a large part to play in helping to solve these individual problems which cannot be ignored since to do so would lead to a wide-spread lowering of morale. It must be remembered also that the need for billeting will continue for a long time after the acute phase of hostilities. Training should prepare the volunteer for the more detailed aspect of long-term welfare; some of the service for which training is given may not be needed or may not be practicable, but it is better to train to the ideal and to get as near to it in practice as circumstances permit.

Visiting and supervision of billets

4 (*a*) The amount of visiting will depend on conditions existing at the time and the number of suitable staff available. The initial introduction of evacuee to householder should if possible be made by a responsible person. Doorstep altercations may be avoided if both sides feel that the situation is being handled by some one in authority.

(*b*) Billeting visitors would form a link between the household and the billeting office. Very large numbers of billeting assistants and visitors will be needed if they are to keep in touch with households. There will be a need for tact and complete impartiality, as well as a detailed knowledge of the help available.

(*c*) Billets should be visited within a few days of the initial billeting in order to advise on major difficulties which may have arisen. Further visits would depend on circumstances. If the household is settling down reasonably well, it would be better not to visit too often, but both householder and evacuee must know where to go if help is needed.

(*d*) In billets where there are unaccompanied children regular visits should be made. Frequent visits should be made in the early stages; later, if all seems well, once a month might be sufficient. Children who were in the care of the local authority (i.e., under the Children Act, 1948 or the Children and Young Persons' Act, 1933) at the time of evacuation, would come under the supervision of the Children's Officer in the reception area; other unaccompanied children would be supervised by the staff of the billeting officer.

Problems of shared homes

5 (*a*) Sharing a home is never easy even when the families are known to each other and sharing is by mutual agreement. Sharing under conditions resulting from evacuation will be infinitely more difficult.

(*b*) As far as possible householder and evacuee should work out their own plan for sharing, but the billeting visitor should be ready to discuss plans and to advise if asked to do so. Both evacuee and householder should appreciate the other's point of view; preparatory work in this connection might be possible.

(*c*) Common difficulties arising from shared homes:

(i) responsibility for shared kitchens and bathrooms; timing of meals, etc.;
(ii) apportionment of cost of light and fuel;
(iii) responsibility for cleaning passages, stairs, etc.;
(iv) use of cleaning materials and cooking utensils.

(*d*) The social standards and customs of evacuees and householder may be entirely different. The easiest solution would be for families to live completely independently but the size of the house and the available rooms might make this impracticable.

Needs of special groups

Unaccompanied children

6 (*a*) Special arrangements will be made for certain groups of unaccompanied children, i.e. (1) nursery and nursery school children (2) children attending special schools (e.g., for the handicapped). These groups will be accompanied by their own staff and will go to pre-arranged accommodation in the reception areas; it is unlikely that Welfare Section members will be called upon to help.

(*b*) Those children whose relatives cannot accompany them will be collected together in parties, sent to reception areas and billeted in private houses. The choice of billets for unaccompanied children should receive special care:

(i) they should only be billeted on persons willing to accept them;
(ii) if possible they should be billeted on persons accustomed to the care of children;
(iii) the billet must be visited regularly to ensure that the children are being well cared for. The billeting visitor should establish friendly relations with the householder so that visits are not looked upon as an intrusion but as an opportunity for friendly discussion.

(*N.B. See earlier reference to children in care of the local authority.*)

(*c*) Even householders accustomed to children may not be prepared for problems which may arise when a child is separated from his family. Such problems are likely to be more acute when separation is the result of hurried evacuation without an opportunity for mental preparation. The child's insecurity may show itself in:

(i) bed-wetting;
(ii) problems of behaviour—extreme aggressiveness or timidity, temper tantrums, pilfering.

Kindness and commonsense handling will usually enable the difficulties to be overcome, but the billeting visitor must be able to advise the householder and must know what practical help is available. Cases of real difficulty should be reported to the billeting officer.

7 In addition to unaccompanied children there will be other groups whose welfare will need special consideration:

(a) Expectant mothers

Special arrangements will be made for those within one month of their expected date of confinement; others will be billeted in the ordinary way but may move to special lying-in accommodation later, if such accommodation should be available.

The address of expectant mothers' billets should be notified to the Medical Officer of Health so that Health Visitors may visit and advise. On leaving hospital, mother and baby will be re-billeted. It would be an obvious advantage if they could return to her former billet. Special arrangements may have to be made for the care of other children in the family while their mother is in hospital.

(b) Aged-infirm, blind persons and cripples

If the degree of infirmity or handicap is not too great, these will be billeted in private households. Many aged and handicapped will be accompanied by members of their family who will be responsible for their general welfare. Those who are unaccompanied may need specially selected billets:

(i) With householders who are prepared to give the extra care necessary.

(ii) In houses suitable for the particular disability, e.g., few stairs, indoor sanitation, etc.

The local authority's welfare officer and/or any appropriate voluntary organisation in the neighbourhood should be put in touch.

(c) Adolescents

A new priority class in the revised evacuation scheme. In general, adolescents will be part of family units and may be billeted with that family. They may need suitable work and this will be dealt with by the local office of the Ministry of Labour and National Service. Where possible, organised activity for out-of-work hours should be arranged. Social clubs and organisations should be asked to extend their facilities to evacuated young people. Billeting visitors should know what is available.

Notes on teaching WE 10

8 Volunteers who are likely to be called upon to act as billeting visitors should take advantage of any opportunity of any activity which brings them in contact with all types of people, e.g., helping with clubs, outings, welfare clinics, etc. and so gain experience in social work.

9 The instructor should make it clear that the priority classes mentioned in his talk are those of the provisional evacuation scheme.

10 Volunteers should make themselves familiar with the peace-time welfare services in their neighbourhood, both statutory and voluntary, but must realise that many, if not all, of these services might be disrupted by war.

11 In dealing with human problems the personality of the individual concerned plays a very large part in deciding how a situation may best be handled. Any approach must be extremely flexible and capable of being adapted to meet the circumstances.

Environmental Radiation Protection Factors
Provided by Civilian Vehicles

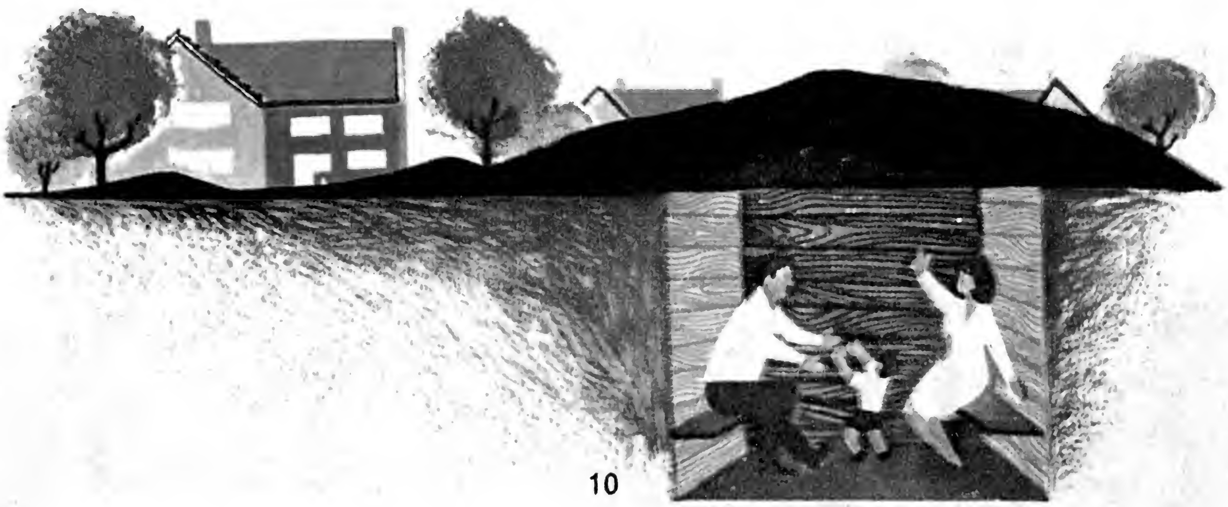
Vehicle	Position	Protection Factor Range
Commercial bus (common type)	Throughout bus	1.5-2.0
Commercial bus (scenic cruiser type)	Throughout bus	1.5-2.0
School bus	Throughout bus	1.5-1.8
Passenger car	Passenger side (chest)	1.5-1.7
	Driver side	1.5-1.7
Pickup	Driver side	1.9-2.1
Crew cab	Driver side	1.8-2.0
	Back seat	1.8-2.0
Carryall	Driver side	1.7-1.9
	Rear side	1.7-1.9
2-1/2-ton truck	Driver side	1.8-2.0
	Center of bed	1.4-1.6
5-ton truck	Driver side	2.0-2.2
	Sleeper	1.9-2.1
Heavy Truck	Driver side	1.4-1.6
	Center of trailer	2.7-3.1
Fire truck	Driver side	2.7-3.1
	Standing area in back	1.6-1.8
Switch engine	Engineer's seat	3.0-3.5
Railway guard car	Sleeping quarters	2.2-2.6
	Kitchen area	2.4-2.8
	Center area	2.0-2.4
Heavy locomotive	Engineer's seat	3.0-3.5

SOURCE: Z. G. Burson, "Environmental and Fallout Gamma Radiation Protection Factors Provided by Civilian Vehicles," Health Physics, 26, 41-44, 1974.

SHELTER "CORES"

Outdoor Fall-out Shelter

If it is impossible for you to prepare an indoor fall-out shelter, a trench dug outside your home would provide good protection. It should be deep enough to provide comfortable standing room and the sides should be shored up. After placing supports across the trench, cover the top with boards, metal sheets or concrete slabs, and heap earth on top. Leave a manhole-type entrance with a movable cover such as a dustbin lid. Keep a small ladder or a pair of household steps there.



UK CD Handbook 10, Advising the Householder, January 1963

PERSONAL AND FAMILY SURVIVAL

SM-3-11

"...the history of this planet and particularly the history of the 20th Century is sufficient to remind us of the possibilities of an irrational attack, a miscalculation, and accidental war, or a war of escalation in which the stakes by each side gradually increase to the point of maximum danger which cannot be either foreseen or deterred. It is on this basis that civil defense can be readily justified—as insurance for the civilian population in case of enemy miscalculation. It is insurance we trust will never be needed—but insurance which we would never forgive ourselves for foregoing in the event of catastrophe."

— President Kennedy, in May 1961

Remove doors from their hinges and place them over supports

Drinking-water is required for survival. It is also useful as a shielding material. A collapsible children's swimming pool filled with water and located over the best corner of your basement will help improve the fallout protection. A bathtub, if suitably located, can also be used for this purpose.

DEPARTMENT OF DEFENSE
OFFICE OF CIVIL DEFENSE

Foreword

If the country were ever faced with an immediate threat of nuclear war, a copy of this booklet would be distributed to every household as part of a public information campaign which would include announcements on television and radio and in the press. The booklet has been designed for free and general distribution in that event. It is being placed on sale now for those who wish to know what they would be advised to do at such a time.

May 1980

Protect and Survive
ISBN 0 11 3407289

If Britain is attacked by nuclear bombs or by missiles, we do not know what targets will be chosen or how severe the assault will be.

If nuclear weapons are used on a large scale, those of us living in the country areas might be exposed to as great a risk as those in the towns. The radioactive dust, falling where the wind blows it, will bring the most widespread dangers of all. No part of the United Kingdom can be considered safe from both the direct effects of the weapons and the resultant fall-out.

The dangers which you and your family will face in this situation can be reduced if you do as this booklet describes.

Planning for survival

Stay at Home

Your own local authority will best be able to help you in war.
If you move away – unless you have a place of your own to go to or intend to live with relatives – the authority in your new area will not help you with accommodation or food or other essentials.
If you leave, your local authority may need to take your empty house for others to use.
So stay at home.

Plan a Fall-out Room and Inner Refuge

The first priority is to provide shelter within your home against radioactive fall-out. Your best protection is to make a fall-out room and build an inner refuge within it.

First, the Fall-out room

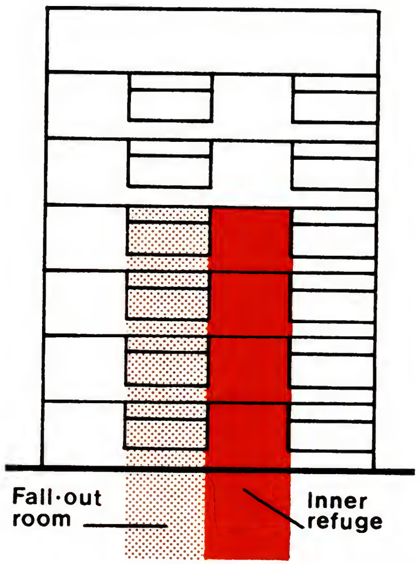
Because of the threat of radiation you and your family may need to live in this room for fourteen days after an attack, almost without leaving it at all. So you must make it as safe as you can, and equip it for your survival. Choose the place furthest from the outside walls and from the roof, or which has the smallest amount of outside wall. The further you can get, within your home, from the radioactive dust that is on or around it, the safer you will be. Use the cellar or basement if there is one. Otherwise use a room, hall or passage on the ground floor.

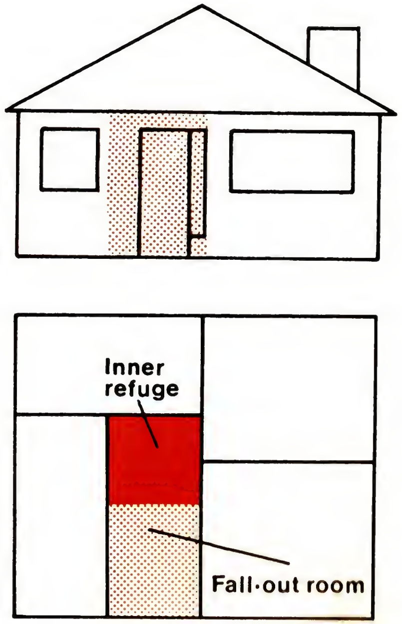
Now the Inner Refuge

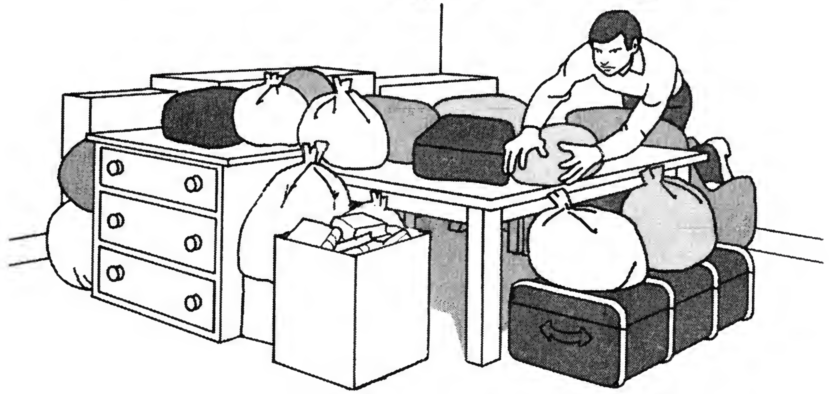
Still greater protection is necessary in the fall-out room, particularly for the first two days and nights after an attack, when the radiation dangers could be critical. To provide this you should build an inner refuge. This too should be thick-lined with dense materials to resist the radiation, and should be built away from the outside walls.

Here are some ideas:

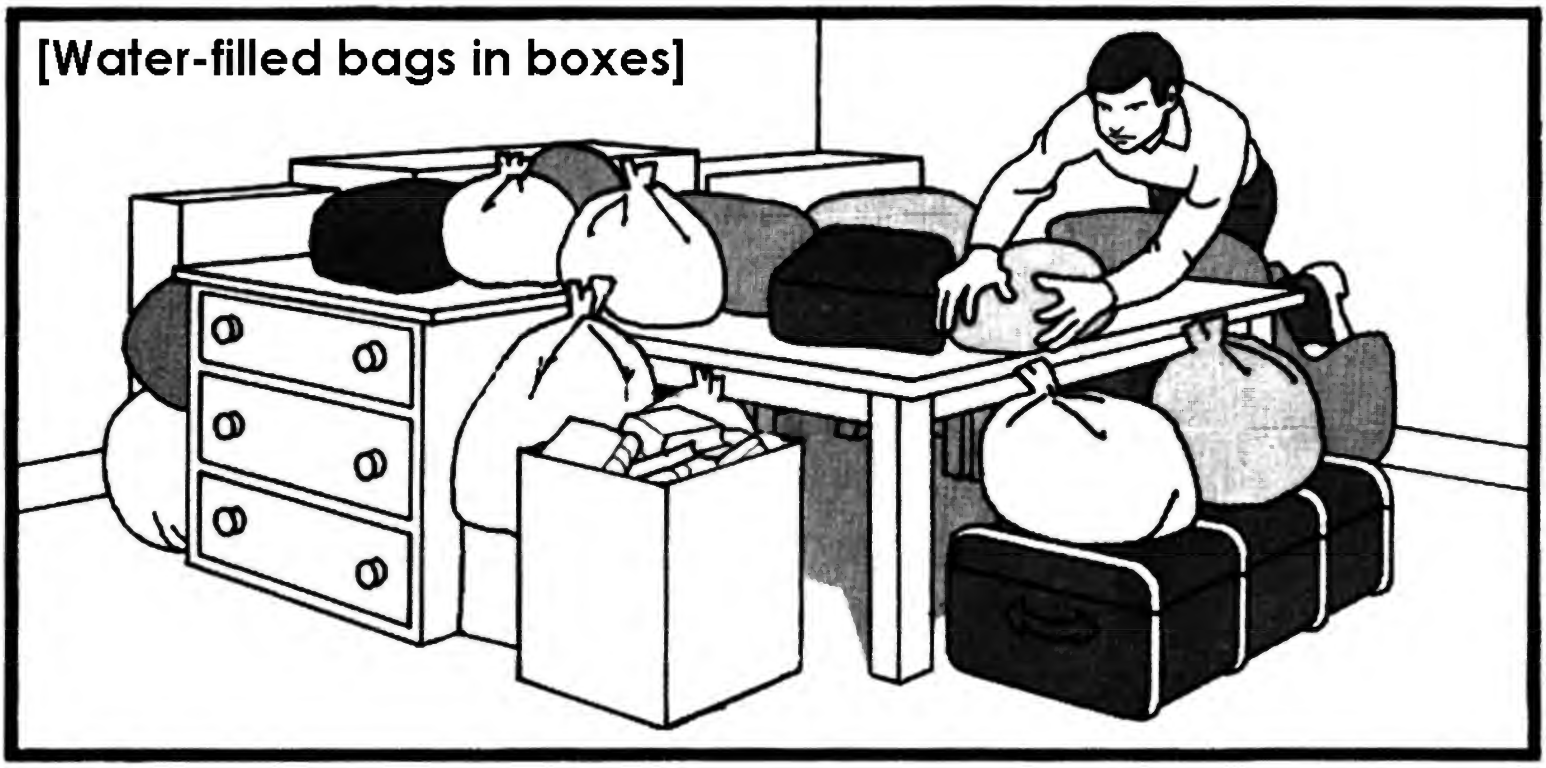
Make a 'lean-to' with sloping doors taken from rooms above or strong boards rested against an inner wall. Prevent them from slipping by fixing a length of wood along the floor. Build further protection of bags or boxes of earth or sand – or books, or even clothing – on the slope of your refuge, and anchor these also against slipping. Partly close the two open ends with boxes of earth or sand, or heavy furniture.





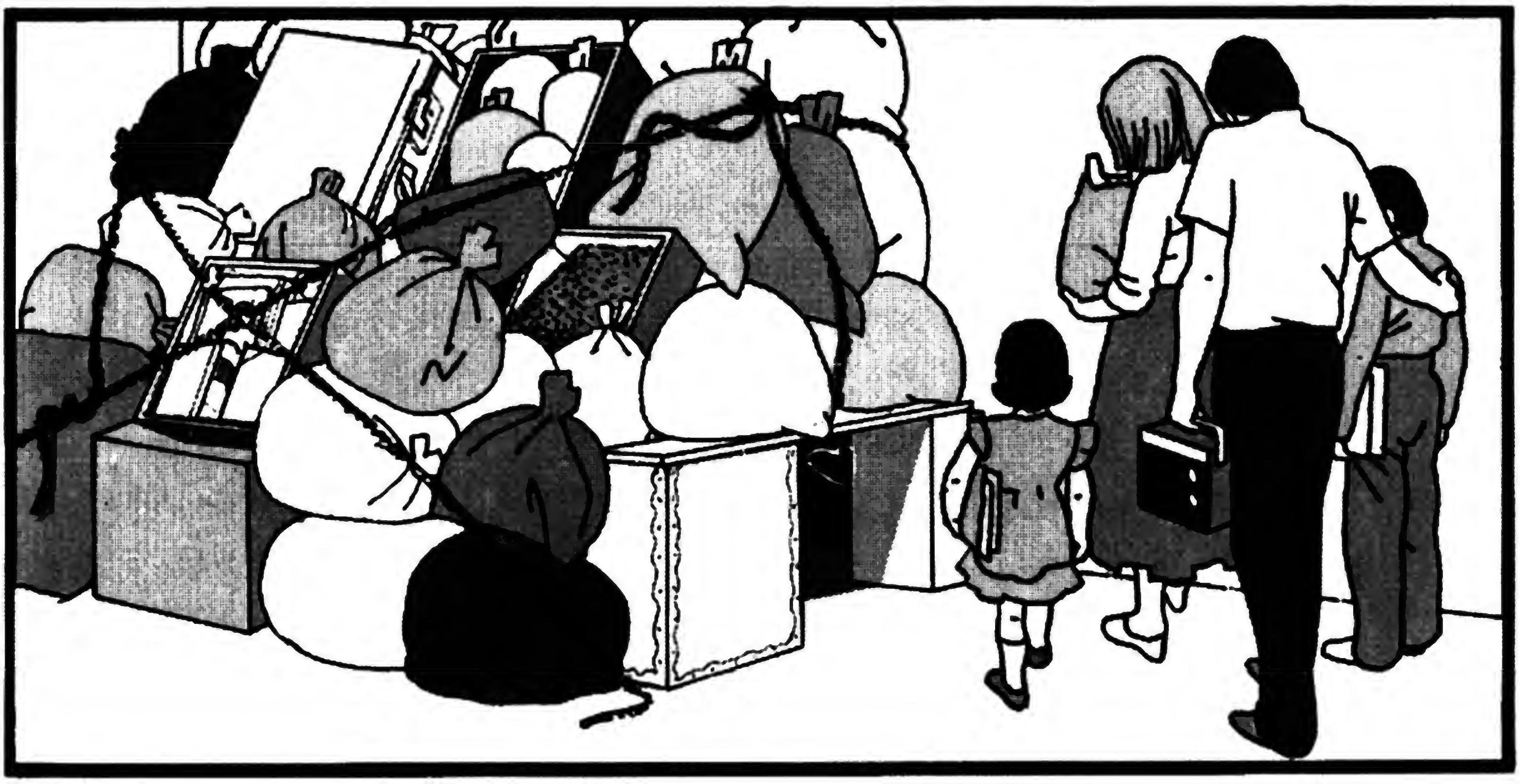


Protect and Survive
UK Government, May 1980



If there is structural damage from the attack you may have some time before a fall-out warning to do minor jobs to keep out the weather – using curtains or sheets to cover broken windows or holes.

If you are out of doors, take the nearest and best available cover as quickly as possible, wiping all the dust you can from your skin and clothing at the entrance to the building in which you shelter.



Proceedings of the Symposium
held at Washington, D. C.
April 19-23, 1965 by the
Subcommittee on Protective Structures,
Advisory Committee on Civil Defense,
National Academy of Sciences—
National Research Council

Protective Structures

for

CIVILIAN POPULATIONS

1966

THE PROTECTION AGAINST FALLOUT RADIATION AFFORDED BY CORE SHELTERS IN A TYPICAL BRITISH HOUSE

Daniel T. Jones
Scientific Adviser, Home Office, London

Protective Factors in a Sample of British Houses (Windows Blocked)

Protective Factor	Percentage of Houses
< 25	36%
25-39	28%
40-100	29%
> 100	7%

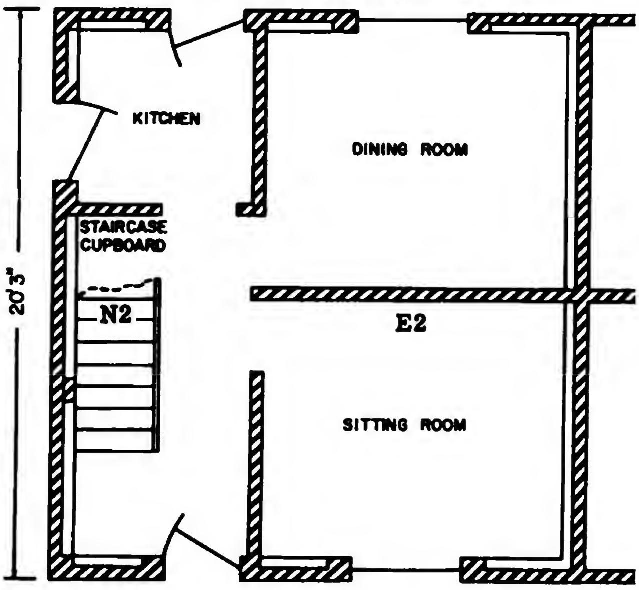
"A very much improved protection could be obtained by constructing a shelter core. This means a small, thick-walled shelter built preferably inside the fallout room itself, in which to spend the first critical hours when the radiation from fallout would be most dangerous."(1)

The full-scale experiments were carried out at the Civil Defense School at Falfield Park.(2)

In the staircase construction, the shelter consisted of the cupboard under the stairs, sandbags being placed on treads above and at the sides.

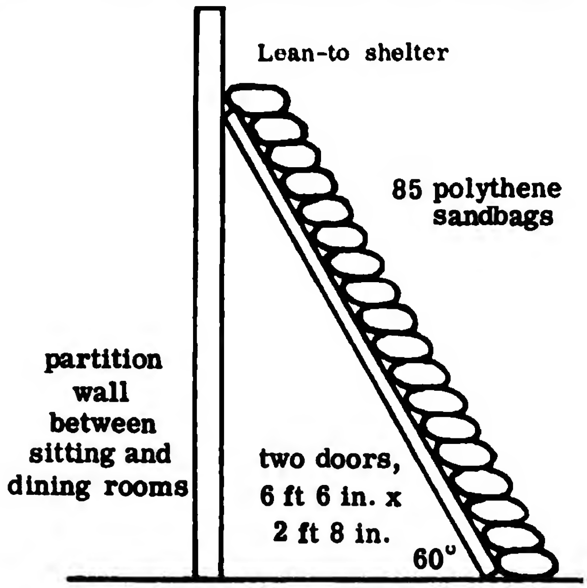
A 93 curies cobalt-60 source was used.

1. Six sandbags per tread, and a double layer on the small top landing. 96 sandbags were used.
2. As (1), together with a 4-ft-high wall of sandbags along the external north wall. 160 sandbags were used.
3. As (2), together with 4-ft-high walls of sandbags along the kitchen/cupboard partition wall and along the passage partition. 220 sandbags were used.



sandbags 24 in. x 12 in. when empty; 16 in. x 9 in. x 4 in. when filled with 25 lb of sand.

9 in. brick walls The windows and doors were not blocked	Position	contribution r/hr/c/ft^2 Ground	Roof	Protective Factor
House only	E2	15.0	8.4	21
Lean-to	E2	10.4	2.4	39
Staircase cupboard:				
Stairs only sandbagged	N2	29.2	5.3	14
Stairs and outer wall sandbagged	N2	16.4	4.6	24
Stairs, outer wall, kitchen wall and corridor partition sandbagged	N2	8.8	1.8	47



floor area 21 sq ft.

1. Civil Defence Handbook No. 10, HMSO, 1963.
2. Perryman, A. D., Home Office Report CD/SA 117.

MODEL ANALYSIS

Mr. Ivor Ll. DAVIES
Suffield Experimental Station
Canadian Defense Research Board
Ralston, Alberta, Canada

Nuclear-Weapon Tests

In 1952 we fired our first nuclear device, effectively a "nominal" weapon, at Monte Bello, off northwest Australia. To the blast loading from this weapon we exposed a number of reinforced-concrete cubicle structures that had been designed for the dynamic loading conditions, and for which we made the best analysis of response we were competent to make at that time. Our estimates of effects were really a dismal failure. The structures were placed at pressure levels of 30, 10, and 6 psi, where we expected them to be destroyed, heavily damaged with some petaling of the front face, and extensively cracked, respectively. In fact, the front face of the cubicle at 30 psi was broken inwards; failure had occurred along both diagonals, and the four triangular petals had been pushed in. At the 10-psi level, where we had three cubicles, each with a different wall thickness (6, 9, and 12 in.), we observed only light cracking in the front face of that cubicle with the least thick wall (6 in.). The other two structures were apparently undamaged, as was the single structure at the 6-psi level.

In 1957, the first proposals were made for the construction of the underground car park in Hyde Park in London. The Home Office was interested in this project since, in an emergency, the structure could be used as a shelter. Consequently a request was made to us at Atomic Weapons Research Establishment (A.W.R.E.) to design a structure that would be resistant to a blast loading of about 50 psi, and to test our design on the model scale.

Using the various load-deformation curves obtained in this test, an estimate was made of the response of the structure to blast loading. Of particular interest was the possible effect of 100 tons of TNT, the first 100-ton trial at Suffield in Alberta.

10 p.s.i.

34 p.s.i.

Dynamic tests, Monte Bello cubicles.

A total of seven more models was made; six were shipped to Canada and placed with the top surface of the roof flush with the ground and at positions where peak pressures of 100, 80, 70, 60, 50, and 40 psi were expected. The seventh model was kept in England for static testing at about the time of firing. The results were not as expected. In the field, the four models farthest from the charge were apparantly undamaged; we could see no cracking with the eye, nor did soaking the models with water reveal more than a few hair cracks. The model nearest the charge was lightly cracked in the roof panels and beams, and one of the columns showed slight spalling at the head. This model had been exposed to a peak pressure of 110 psi.

BLAST AND OTHER THREATS

Harold Brode
The RAND Corporation, Santa Monica, California

Chemical High-Explosive Weapons

As in past aerial warfare, bombs and missiles carrying chemical explosives to targets are capable of extensive damage only when delivered in large numbers and with high accuracy.

Biological Warfare

Most biological agents are inexpensive to produce; their effective dissemination over hostile territories remains the chief deterrent to their effective employment. Twenty square miles is about the area that can be effectively covered by a single aircraft; large area coverage presents a task for vast fleets of fairly vulnerable planes flying tight patterns at modest or low altitudes. While agents vary in virulence and in their biologic decay rate, most are quite perishable in normal open-air environments. Since shelter and simple prophylactic measures can be quite effective against biological agents, there is less likelihood of the use of biological warfare on a wholesale basis against a nation, and more chance of limited employment on population concentrations —perhaps by covert delivery, since shelters with adequate filtering could insure rather complete protection to those inside.

Chemical Weapons

Chemical weapons, like biological weapons, are relatively inexpensive to create, but face nearly insurmountable logistics problems on delivery. Although chemical agents produce casualties more rapidly, the greater amounts of material to deliver seriously limit the likelihood of their large-scale deployment. Furthermore, chemical research does not hold promise of the development of significantly more toxic chemicals for future use.

Radiological Weapons

The advantages of such modifications are much less real than apparent. In all weapons delivered by missiles, minimizing the payload and total weight is very important. If the total payload is not to be increased, then the inclusion of inert material to be activated by neutrons must lead to reductions in the explosive yield. If all the weight is devoted to nuclear explosives, then more fission-fragment activity can be created, and it is the net difference in activity that must be balanced against the loss of explosive yield. As it turns out, a fission explosion is a most efficient generator of activity, and greater total doses are not achieved by injecting special inert materials to be activated.

Perret, W.R., Ground Motion Studies at High Incident Overpressure, The Sandia Corporation, Operation PLUMBBOB, WT-1405, for Defense Atomic Support Agency Field Command, June 1960.

The Neutron Bomb

The neutron bomb, so called because of the deliberate effort to maximize the effectiveness of the neutrons, would necessarily be limited to rather small yields—yields at which the neutron absorption in air does not reduce the doses to a point at which blast and thermal effects are dominant. The use of small yields against large-area targets again runs into the delivery problems faced by chemical agents and explosives, and larger yields in fewer packages pose a less stringent problem for delivery systems in most applications. In the unlikely event that an enemy desired to minimize blast and thermal damage and to create little local fallout but still kill the populace, it would be necessary to use large numbers of carefully placed neutron-producing weapons burst high enough to avoid blast damage on the ground, but low enough to get the neutrons down. In this case, however, adequate radiation shielding for the people would leave the city unscathed and demonstrate the attack to be futile.

The thermal radiation from a surface burst is expected to be less than half of that from an air burst, both because the radiating fireball surface is truncated and because the hot interior is partially quenched by the megatons of injected crater material.

SUPERSEISMIC GROUND-SHOCK MAXIMA (AT 5-FT DEPTH)

Vertical acceleration: $\alpha_{vm} \simeq 340\, \Delta P_s / C_L$ ± 30 per cent. Here acceleration is measured in g's and overpressure (ΔP_s) in pounds per square inch. An empirical refinement requires C_L to be defined as the seismic velocity (in feet per second) for rock, but as three fourths of the seismic velocity for soil.

OUTRUNNING GROUND-SHOCK MAXIMA (AT ~10-FT DEPTH)

Vertical acceleration: $\alpha_{vm} \simeq 2 \times 10^5 / C_L r^2$ + factor 4 or -factor 2. Acceleration is measured in g's, and r is the scaled radial distance—i.e., $r = R/W^{1/3}$ kft/(mt)$^{1/3}$.

Data taken on a low air-burst shot in Nevada indicate an exponential decay of maximum displacement with depth. For the particular case of a burst of ~ 40 kt at 700 ft, some measurements were made as deep as 200 ft below the surface of Frenchman Flat, a dry lake bed, which led to the following approximate decay law, according to Perret.

$\delta = \delta_0 \exp(-0.017D)$,

where δ represents the maximum vertical displacement induced at depth D, δ_0 is the maximum displacement at the surface, and D is the depth in feet.

18th April, 1950.

Sir,

Civil Defence Act, 1948
Regulations relating to the Evacuation of the
Civil Population (Statutory Instrument 1949, No.2147)

1. I am directed to refer to Circular 81/49 (Wales) of 23rd August, 1949, which transmitted for your information a copy of the draft Civil Defence (Evacuation and Care of the Homeless) Regulations, 1949. These Regulations have now been approved by both Houses of Parliament and are now operative. I am now to enclose a copy of a Memorandum on Evacuation (Memo Ev.1 (1950) which contains an outline of the general plan for the transfer of certain sections of the civilian population from the more densely populated areas in the event of war or the imminence of war. For the purpose of this transfer the system developed in the 1939/45 war has been adopted, whereby the country is divided into evacuation, neutral and reception areas

9. ESTIMATES OF ACCOMMODATION IN RECEPTION AREAS

In order that specific allocations may be worked out and each Reception Authority informed of the number of members of the priority classes for whom their plans should provide, it is requested that every Reception Authority will prepare an estimate of the total number of habitable rooms in their area. The Minister of Health has been advised by the Associations of Local Authorities that the Receptio Authorities (who are the Housing Authorities) will be able to make reasonably accurat estimates from information already available to them. The estimate should include all rooms normally used in the locality either as living rooms or as bedrooms. I am to ask that this estimate may be forwarded to the Department, not later than 30th June, 1950.

10. The Department do not consider that any useful purpose would be served by carrying out at this stage a detailed survey of the accommodation which could be made available for evacuees such as was undertaken in January, 1939.

IV. LATER ACTION

11. When the specific allocations of the number of members of the priority classes for whose reception arrangements should be made in each reception area have been decided, it will be possible to link each Reception Authority with a particular Evacuation Authority. When the plan has been developed in this way, or as the

---

14. The Memorandum on Evacuation (Memo Ev.1 (1950) has been placed on sale. Further copies may be purchased direct from His Majesty's Stationery Office or from any bookseller.

I am, Sir,
Your obedient Servant,

William Thomas

The Clerk of the Council.

LINKING OF EVACUATION AND RECEPTION AREAS FOR ORGANISED EVACUATION

MERSEYSIDE GROUP

EVACUATION AREAS

Liverpool C.B.	Bebington B.
Birkenhead C.B.	Widnes B.
Wallasey C.B.	Litherland U.D.
Bootle C.B.	Northwich U.D.
Crosby B.	Runcorn U.D.
	Ellesmere Port U.D.

Estimated Civil Population, 1,320,000 *

Estimated number of members of priority classes, 376,300

ASSOCIATED RECEPTION AREAS

County	Local Authority	Estimated Civil Population *
Cheshire	Chester C.B.	48,000
	Alsager U.D.	5,000
	Hoole U.D.	9,000
	Hoylake U.D.	26,000
	Middlewich U.D.	6,000
	Nantwich U.D.	9,000
	Neston U.D.	9,000
	Sandbach U.D.	9,000
	Winsford U.D.	12,000
	Wirral U.D.	17,000
	Chester R.D.	19,000
	Nantwich R.D.	26,000
	Tarvin R.D.	15,000
	Total	210,000
Lancashire	Blackpool C.B.	152,000
	Southport C.B.	84,000
	Colne B.	20,000
	Fleetwood B.	26,000
	Nelson B.	34,000
	Adlington U.D.	4,000
	Barrowford U.D.	5,000
	Brierfield U.D.	7,000
	Formby U.D.	9,000
	Kirkham U.D.	4,000
	Ormskirk U.D.	21,000
	Padiham U.D.	10,000
	Poulton le Fylde U.D.	8,000
	Preesall U.D.	2,000
	Skelmersdale U.D.	6,000

* Registrar-General's estimate of civil population as at mid-1948.

ASSOCIATED RECEPTION AREAS (Contd.)

County	Local Authority	Estimated Civil Population *
Cardigan	Aberystwyth B.	10,000
	Cardigan B.	3,000
	Lampeter B.	2,000
	Aberayron U.D.	1,000
	New Quay U.D.	1,000
	Aberayron R.D.	9,000
	Aberystwyth R.D.	10,000
	Teifiside R.D.	10,000
	Tregaron R.D.	5,000
	Total	51,000
Denbigh	Colwyn Bay B.	23,000
	Denbigh B.	8,000
	Ruthin B.	4,000
	Wrexham B.	29,000
	Abergele U.D.	7,000
	Llangollen U.D.	3,000
	Llanrwst U.D.	3,000
	Aled R.D.	7,000
	Ceiriog R.D.	7,000
	Hiraethog R.D.	5,000
	Ruthin R.D.	10,000
	Wrexham R.D.	62,000
	Total	168,000
Flint	Flint B.	14,000
	Buckley U.D.	8,000
	Connah's Quay U.D.	7,000
	Holywell U.D.	8,000
	Mold U.D.	6,000
	Prestatyn U.D.	8,000
	Rhyl R.D.	19,000
	Hawarden R.D.	32,000
	Holywell R.D.	22,000
	Overton R.D.	6,000
	St. Asaph R.D.	8,000
	Total	138,000
Merioneth	Bala U.D.	1,000
	Barmouth U.D.	2,000
	Dolgelley U.D.	2,000
	Festiniog U.D.	7,000
	Towyn U.D.	3,000
	Deudraeth R.D.	7,000
	Dolgelley R.D.	8,000
	Edeyrnion R.D.	4,000
	Penllyn R.D.	3,000
	Total	37,000

1939 British Government Evacuation Leaflet.

PUBLIC INFORMATION LEAFLET NO. 3

Read this and keep it carefully. **You may need it.**

1.5 million people were evacuated by train from cities. Another 2 million privately evacuated cities.

British Government evacuation plans began in 1931, 8 years before war. 75% of Manchester's children were evacuated, compared to just 15% in Sheffield where civil defence was dismissed as propaganda by Labour council members in charge.

EVACUATION

WHY AND HOW?

WHY EVACUATION?

There are still a number of people who ask " What is the need for all this business about evacuation? Surely if war comes it would be better for families to stick together and not go breaking up their homes?"

It is quite easy to understand this feeling, because it is difficult for us in this country to realise what war in these days might mean. If we were involved in war, our big cities might be subjected to determined attacks from the air—at any rate in the early stages—and although our defences are strong and are rapidly growing stronger, some bombers would undoubtedly get through.

We must see to it then that the enemy does not secure his chief objects—the creation of anything like panic, or the crippling dislocation of our civil life.

One of the first measures we can take to prevent this is the removal of the children from the more dangerous areas.

THE GOVERNMENT EVACUATION SCHEME

The Government have accordingly made plans for the removal from what are called " evacuable " areas (see list at the back of this leaflet) to safer places called " reception " areas, of school children, children below school age if accompanied by their mothers or other responsible persons, and expectant mothers and blind persons.

The scheme is entirely a voluntary one, but clearly the children will be much safer and happier away from the big cities where the dangers will be greatest.

There is room in the safer areas for these children; householders have volunteered to provide it. They have offered homes where the children will be made welcome. The children will have their schoolteachers and other helpers with them and their schooling will be continued.

WHAT YOU HAVE TO DO

Schoolchildren

Schoolchildren would assemble at their schools when told to do so and would travel together with their teachers by train. The transport of some 3,000,000 in all is an enormous undertaking. *It would not be possible to let all parents know in advance the place to which each child is to be sent but they would be notified as soon as the movement is over.*

If you have children of school age, you have probably already heard from the school or the local education authority the necessary details of what you would have to do to get your child or children taken away. *Do not hesitate to register your children under this scheme, particularly if you are living in a crowded area.* Of course it means heartache to be separated from your children, but you can be quite sure that they will be well looked after. That will relieve you of one anxiety at any rate. You cannot wish, if it is possible to evacuate them, to let your children experience the dangers and fears of air attack in crowded cities.

Children under five

Children below school age must be accompanied by their mothers or some other responsible person. Mothers who wish to go away with such children should register with the Local Authority. *Do not delay in making enquiries about this.*

A number of mothers in certain areas have shown reluctance to register. Naturally, they are anxious to stay by their menfolk. Possibly they are thinking that they might as well wait and see; that it may not be so bad after all. *Think this over carefully and think of your child or children in good time.* Once air attacks have begun it might be very difficult to arrange to get away.

Expectant Mothers

Expectant mothers can register at any maternity or child welfare centre. For any further information inquire at your Town Hall.

The Blind

In the case of the Blind, registration to come under the scheme can be secured through the home visitors, or enquiry may be made at the Town Hall.

The invasion of France in 1940 led to evacuation of children on the East and South coasts to Wales, in preparation for invasion defences. Efforts to evacuate kids to Canada ended when 77 were killed when the City of Benares was sunk by submarine U-48 on 18 September 1940.

Northampton Independent 8.9.39.

THEY are here. They have settled down. Northamptonshire's population has increased by 39,000 with the arrival of evacuees from the vulnerable districts of London, writes an "Independent" representative.

Young children showed a brave exterior and declined to succumb to the emotional pangs of homesickness.

Northampton people with prodigious sympathy have recognised and appreciated the inner feelings of these little children and others being ruthlessly torn from their homes through the unknown contingencies of war; torn from their cherished belongings, their parents and relatives.

PRIVATE ARRANGEMENTS

If you have made private arrangements for getting away your children to relatives or friends in the country, or intend to make them, you should remember that while the Government evacuation scheme is in progress ordinary railway and road services will necessarily be drastically reduced and subject to alteration at short notice. Do not, therefore, in an emergency leave your private plans to be carried out at the last moment. It may then be too late.

If you happen to be away on holiday in the country or at the seaside and an emergency arises, do not attempt to take your children back home if you live in an "evacuable" area.

WORK MUST GO ON

The purpose of evacuation is to remove from the crowded and vulnerable centres, if an emergency should arise, those, more particularly the children, whose presence cannot be of any assistance.

Everyone will realise that there can be no question of wholesale clearance. We are not going to win a war by running away.

Most of us will have work to do, and work that matters, because we must maintain the nation's life and the production of munitions and other material essential to our war effort. For most of us therefore, who do not go off into the Fighting Forces our duty will be to stand by our jobs or those new jobs which we may undertake in war.

Some people have asked what they ought to do if they have no such definite work or duty.

You should be very sure before deciding that there is really nothing you can do. There is opportunity for a vast variety of services in civil defence. YOU must judge whether in fact you can or cannot help by remaining. If you are sure you cannot, then there is every reason why you should go away if you can arrange to do so, but you should take care to avoid interfering with the official evacuation plans. If you are proposing to use the public transport services, make your move either BEFORE the evacuation of the children begins or AFTER it has been completed. You will not be allowed to use transport required for the official evacuation scheme and other essential purposes, and you must not try to take accommodation which is required for the children and mothers under the Government scheme.

For the rest, we must remember that it would be essential that the work of the country should go on. Men and women alike will have to stand firm, to maintain our effort for victory. Such measures of protection as are possible are being pushed forward for the large numbers who have to remain at their posts. That they will be ready to do so, no one doubts.

The "evacuable" areas under the Government scheme are:—

(*a*) London, as well as the County Boroughs of West Ham and East Ham; the Boroughs of Walthamstow, Leyton, Ilford and Barking in Essex; the Boroughs of Tottenham, Hornsey, Willesden, Acton, and Edmonton in Middlesex; (*b*) the Medway towns of Chatham, Gillingham and Rochester; (*c*) Portsmouth, Gosport and Southampton; (*d*) Birmingham and Smethwick; (*e*) Liverpool, Bootle, Birkenhead and Wallasey; (*f*) Manchester and Salford; (*g*) Sheffield, Leeds, Bradford and Hull; (*h*) Newcastle and Gateshead; (*i*) Edinburgh, Rosyth, Glasgow, Clydebank and Dundee.

In some of these places only certain areas will be evacuated. Evacuation may be effected from a few other places in addition to the above, of which notice will be given.

Issued from the Lord Privy Seal's Office July, 1939

15 BOYS—BANG GO THE CHAIRS

Herald 28/4/39 P.7

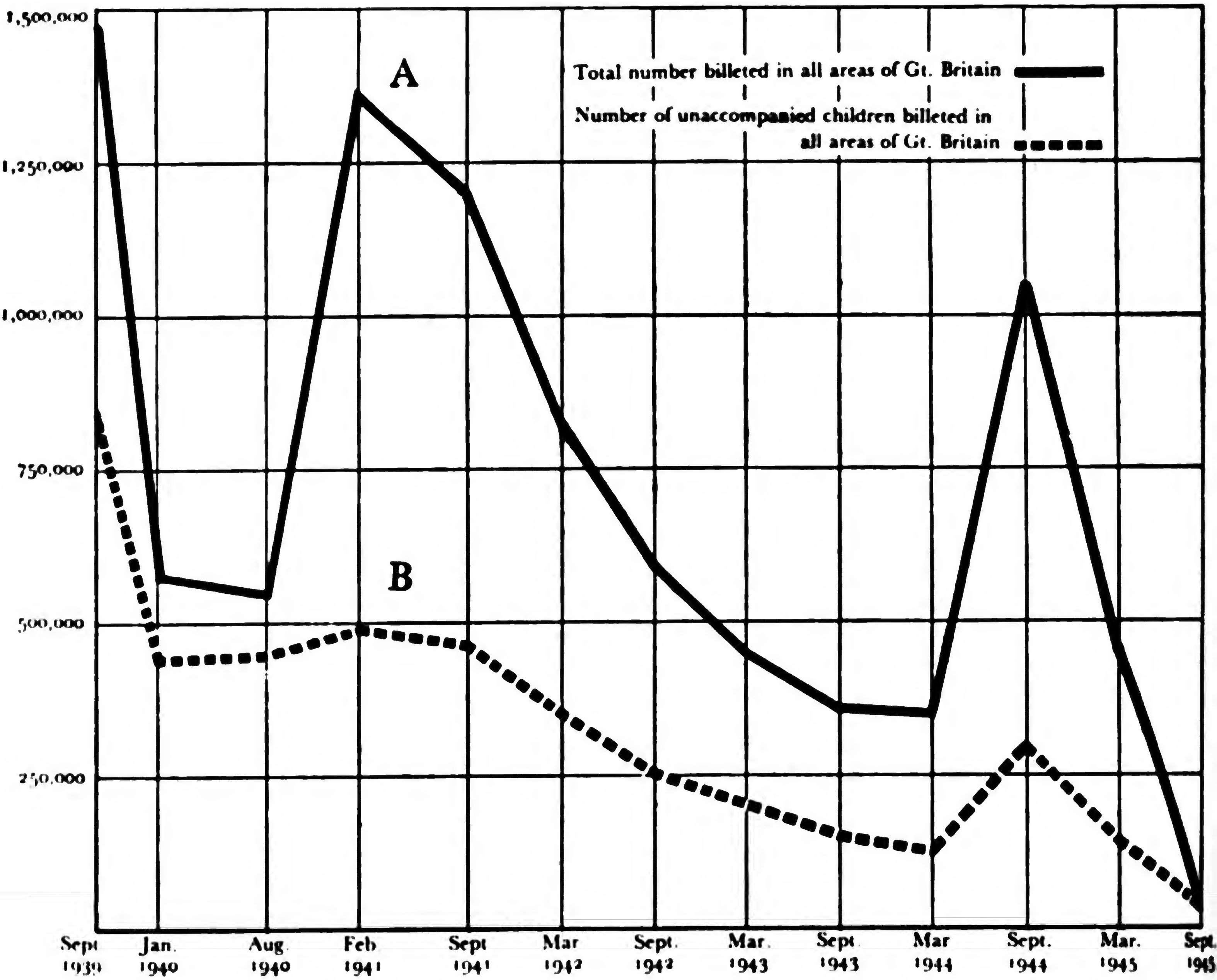
MRS. MAY WELCH, of Beaconsfield Villas, Brighton, has so many children she doesn't know what to do.

But, unlike those of the Old Lady Who Lived in a Shoe, they are not her own. They are evacuees.

She has fifteen—all boys.

"And I can't cope with them," she told the magistrate yesterday when she was summoned for showing a light in the black-out.

"It was one of those boys," she explained. "He took a candle into an empty room."



R. Titmuss, 1950, Problems of Social Policy, page 356: "GOVERNMENT EVACUATION SCHEME 1939–45. The accompanying diagram depicts the important phases in the history of evacuation. Line A represents the total number of persons billeted or otherwise accommodated under Government authority and includes, as well as mothers and children, teachers, helpers, the aged and infirm, homeless people and other assisted groups. Line B picks out only the unaccompanied children."

Use of voluntary services to train civil defence in first aid, etc., prior to WWII:

War Years 39

Under the impact of the emergency there was a rush to acquire first-aid knowledge, which profoundly affected the Association. Certificates issued in 1937 totalled over 48,000. In the peak year of 1940, the number rose to over 298,000.

Class instruction became a major matter. The Government, through air-raid precautions, invited the Association and the Red Cross to train Civil Defence personnel in first-aid and anti-gas measures. . . .

Numerically, the Brigade rose. At the end of 1938 the adult strength was just over 55,000 men and 17,000 women. A year later the figures read: 72,000 men and 31,000 women.

- Joan Clifford, "A Good Uniform: The St John [Ambulance Association] Story", London, 1967

First aid in an underground shelter during World War II.

British Ministry of Health 1939 poster about evacuation: on Friday 1 September 1939, Hitler's Nazis invaded Poland. This IMMEDIATELY triggered Operation Pied Piper, the evacuation of children from cities, PRIOR to Britain declaring war on 3 September 1939!

Where a woman's help is needed

VOLUNTEER FOR THE
Welfare Section

C D

CIVIL DEFENCE CORPS
Ask at your Council Offices


CIVIL DEFENCE
WOMEN WANTED FOR
EVACUATION SERVICE

Effectiveness of Some Civil Defense Actions in Protecting Urban Populations (u)

Appendix B of Defense of the US against Attack by Aircraft and Missiles (u)

ORO-R-17, Appendix B

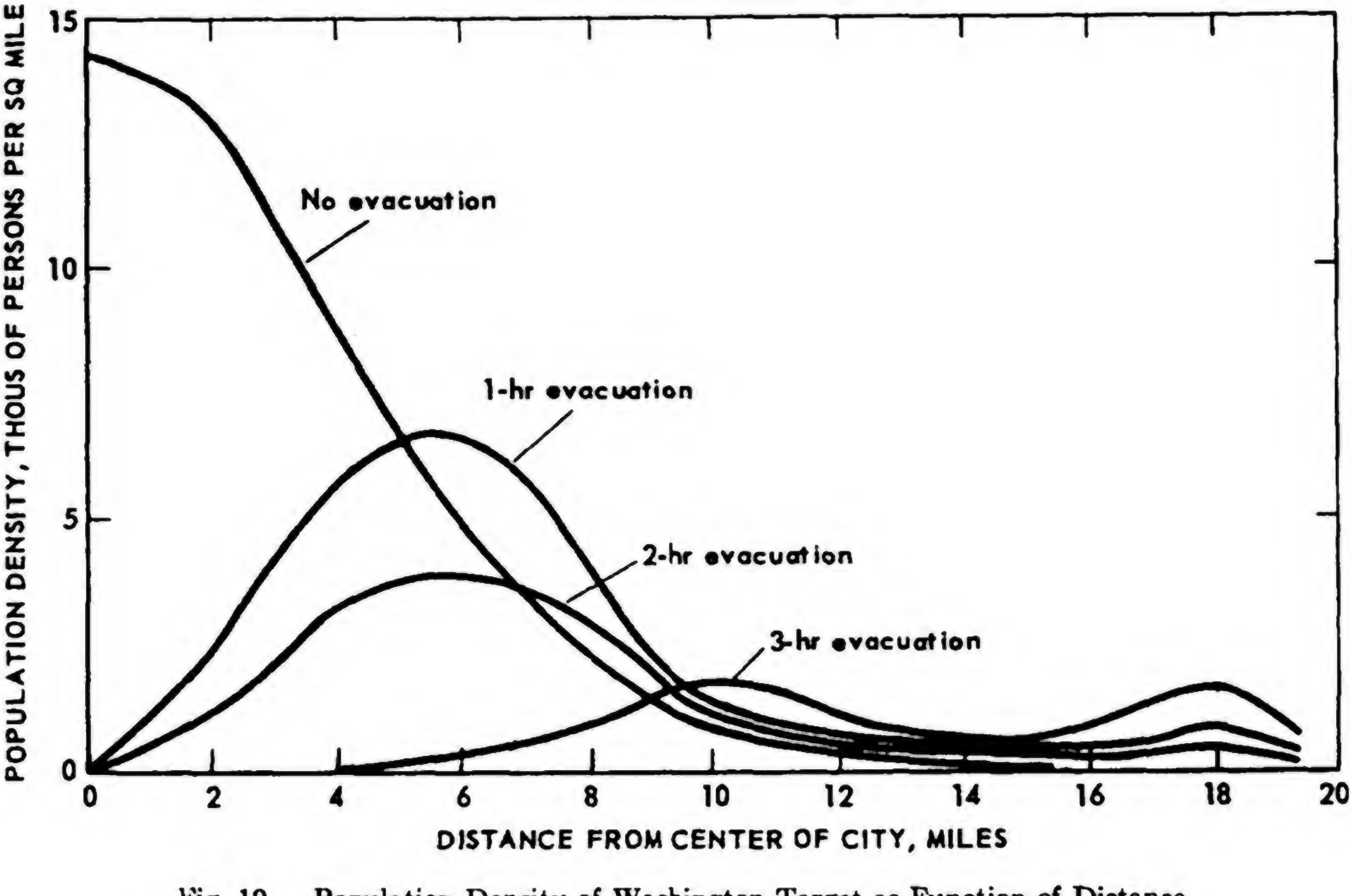


Fig. 10 — Population Density of Washington Target as Function of Distance from Center of City for Three Evacuation Times

THE A.F.S. THE AUXILIARY FIRE SERVICE

A firewoman takes down a message for transmission by "Walkie-Talkie."

AUXILIARY FIREWOMEN are trained to do the same jobs as regular firewomen. They learn organisation and administration, the control and mobilising of fire appliances and how to operate V.H.F. radio. They may be drivers or crews of mobile controls or canteen vans.

THE NUMBER OF ATOMIC BOMBS EQUIVALENT TO THE LAST WAR AIR ATTACKS ON GREAT BRITAIN AND GERMANY

UK National Archives HO 225/16, 30 January 1950, Top Secret

Summary

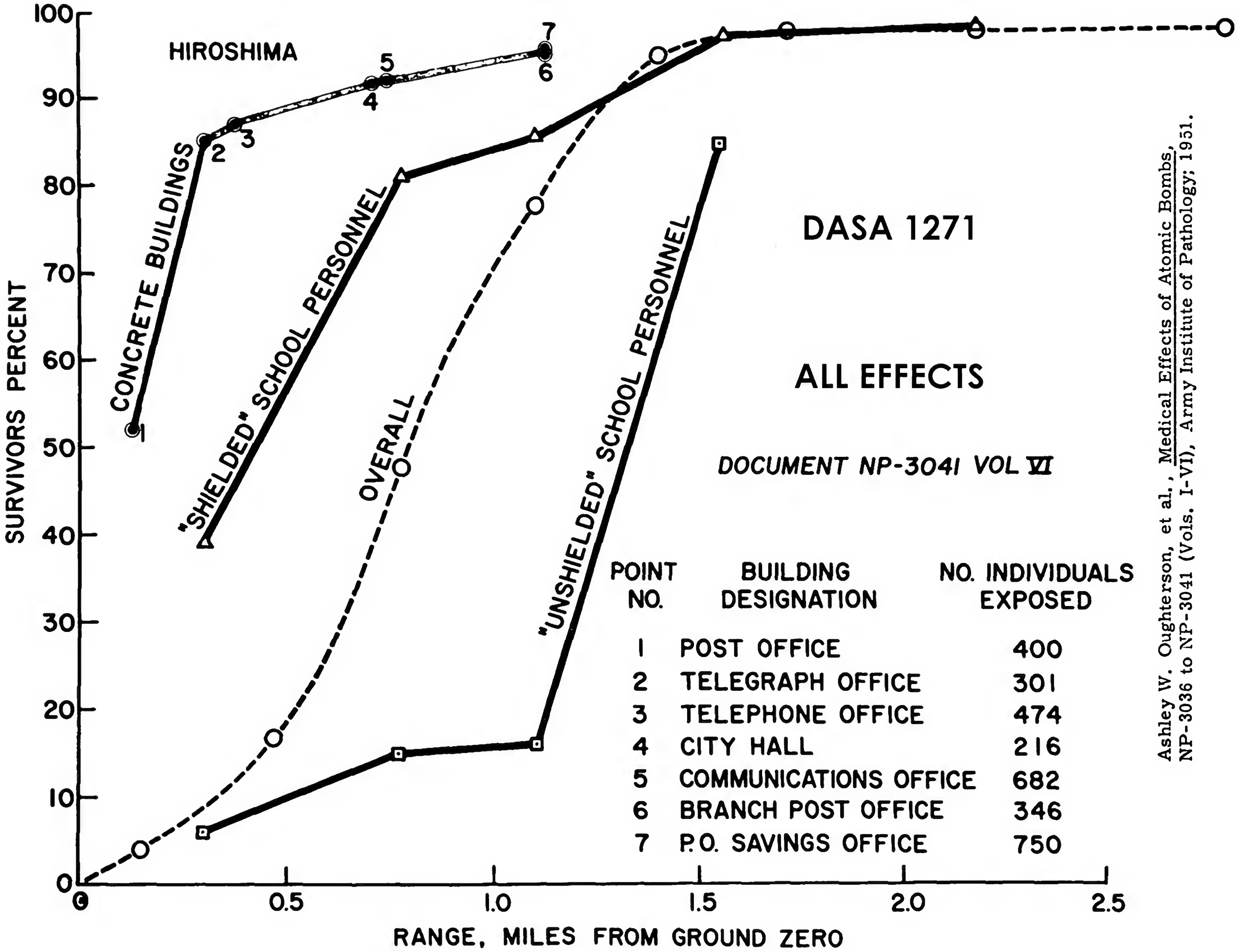
(UK Home Office Scientific Advisory Branch)

During the last war, a total of 1,300,000 tons* of bombs were dropped on Germany by the Strategic Air Forces. If there were no increase in aiming accuracy, then to achieve the same total amount of material damage (to houses, industrial and transportation targets, etc.) would have required the use of over 300 atomic bombs together with some 500,000 tons of high explosive and incendiary bombs for targets too small to warrant the use of an atomic bomb.

This figure for the weight of H.E. equivalent to the atomic bomb for causing casualties increases as the amount of protection of the population increases. Thus for the night raiding conditions on London in the last war, where something like 60% of the population were in houses, 35% in shelter and 5% in the open, the number killed in inner London per ton

of bombs was about 4. For corresponding conditions of exposure it is considered that the deaths from an atomic bomb would be of the order of 25,000, giving an H.E. equivalent of just over 6,000 tons. Taking, therefore, 6,000 tons as the average equivalent for last war conditions of exposure in this country, we get that the 75,000 tons of bombs dropped by the German Air Force were equivalent for causing casualties to about 12 atomic bombs dropped with the accuracy actually achieved by the G.A.F., or to about 3 atomic bombs accurately placed at the centres of big cities.

a much greater total area of damage would be achieved by splitting the mass up and having a number of small explosions rather than one very large explosion. This, of course, is what happened in air attacks with high explosive bombs in the last war.

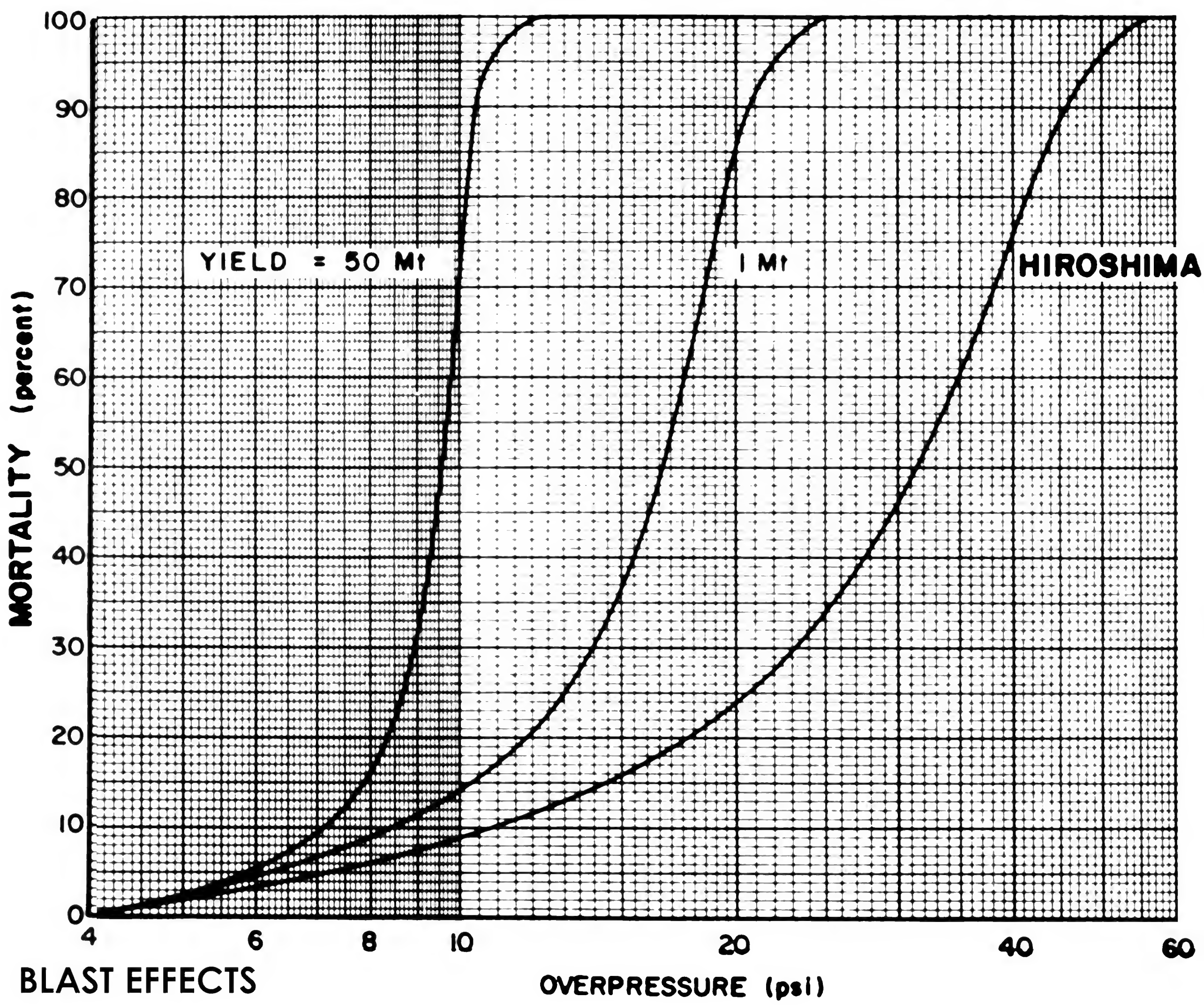


POINT NO.	BUILDING DESIGNATION	NO. INDIVIDUALS EXPOSED
1	POST OFFICE	400
2	TELEGRAPH OFFICE	301
3	TELEPHONE OFFICE	474
4	CITY HALL	216
5	COMMUNICATIONS OFFICE	682
6	BRANCH POST OFFICE	346
7	P.O. SAVINGS OFFICE	750

Ashley W. Oughterson, et al., Medical Effects of Atomic Bombs, NP-3036 to NP-3041 (Vols. I-VI), Army Institute of Pathology; 1951.

DC-P-1060

NONSEISMIC REINFORCED-CONCRETE BUILDINGS



L. Wayne Davis, Donald L. Summers, William L. Baker, and James A. Keller, Prediction of Urban Casualties and the Medical Load from a High-Yield Nuclear Burst, DC-FR-1060, The Dikewood Corporation

BLAST EFFECTS

CD 2333

[redacted]

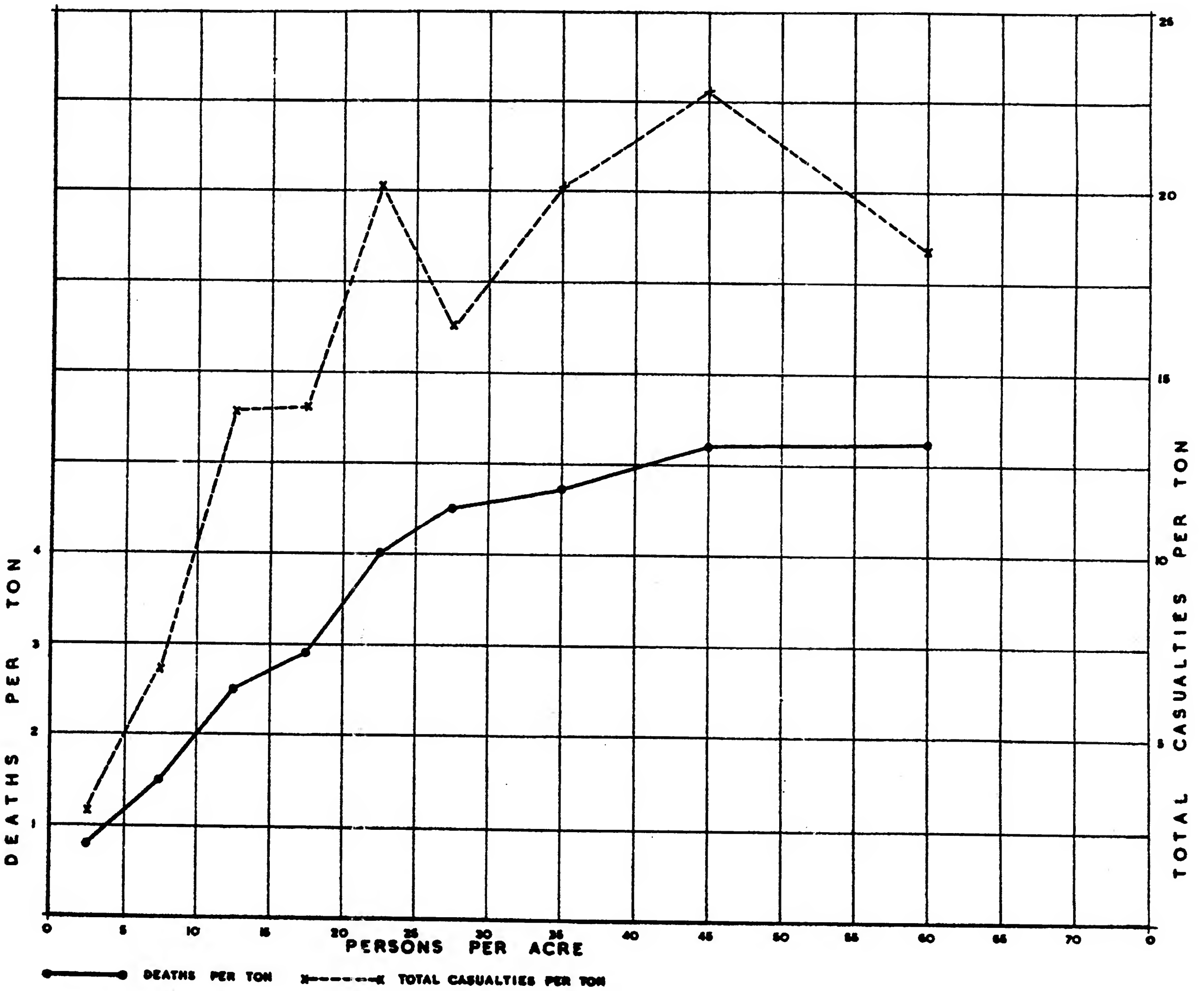
HOME OFFICE

CD/SA 12
Copy. NO 5.

OFFICE OF THE CHIEF SCIENTIFIC ADVISER

A COMPARISON BETWEEN THE NUMBER OF PEOPLE KILLED PER TONNE OF BOMBS DURING WORLD WAR I AND WORLD WAR II

FIG 1 DENSITY OF POPULATION AND CASUALTIES PER TON OF H.E'S. & MINES IN LONDON REGION IN JANUARY TO MAY 1941



BOMB SIZES

$\Rightarrow \approx 175$ kg

For World War II the average bomb weight was between 150 - 200 kg. (R.C. 268, Table 6), whereas for World War I the majority of bombs were 12 or 50 kg. It is known that in World War II the smaller bombs (50 kg.) certainly did not cause fewer deaths per tonne than the larger bombs. Thus on size alone we should expect a higher death rate in World War I if anything.

For the country as a whole the death rate per tonne for World War I was 5.8 times that for World War II. When the comparison is reduced to comparable areas (roughly the county of London) this factor is reduced to 4.25. Differences in population density in the two wars are shown to account for a factor of nearly 2 and differences in exposure for a further factor of 1.5 to 2.

Total casualties include killed and injured

TABLE 1

Casualty rates per tonne for all bombs dropped during the two wars

	Tonnes dropped		Killed		Killed/ tonne		Total casualties		Casualties/ tonne	
	14/18	39/45	14/18	39/45	14/18	39/45	14/18	39/45	14/18	39/45
Whole country	301.8	74,900	1,414	60,595	4.7	.81	4,830	146,777	16.0	1.96
London	62.8	14,800	670	30,300	10.7	2.02	2,630	80,000	41.8	5.41
Remainder	239.0	60,100	744	30,300	3.1	.50	2,200	66,700	9.2	1.11

TABLE 2

Killed rates, London County, for both wars

	Tonnes dropped	Killed	Killed/ tonne
1915/17	19.6	349	17.8
1939/45	3591	15,171	4.2

POPULATION DENSITY

For equal conditions of exposure (i.e. in houses or shelters) it would be expected that the casualties from a bomb would be directly proportional to the density of population round the bomb. This was borne out by the experience of World War II as shown for example in Fig. 1 (taken from R.E.N. 544). It will be seen that deaths per tonne tend to be proportional to population density up to a density of about 25 persons/ acre but that thereafter the rate of increase in death rate with population density is reduced. Two factors might account for this: the greater population densities are associated with greater building densities, and these should provide some measure of shielding, thus reducing the casualty rates. Alternatively in the more densely populated areas more people are known to have gone to shelter, and this again would reduce the casualty rate.

Now in World War I London was more densely populated, and a substantial proportion of the discrepancy between the figures for the two wars is undoubtedly due to this cause.

Mean ratio of densities $\frac{W.W.I}{W.W.II} = 1.94.$

TABLE 5

Relative safeties in World War II deduced from population and casualty distribution

	In the open	Under cover	In shelter
Population exposure	5%	60%	35%
Location people killed	19%	62%	19%
Relative safety	72%	20%	10%

These values are:-

(1) A house about $3\frac{1}{2}$ times as safe as in the open.
(2) A shelter about twice as safe as a house.

TABLE 6

Relation between various population exposures and death rate for World War I compared with known exposure for World War II

	Population exposure			Ratio $\frac{\text{death rates W.W.I}}{\text{" " W.W.II}}$	Location of killed		
	% in open	% in cover	% in shelter		% in open	% in cover	% in shelter
World War II	5	60	35	1	19	62	19
Possible distribution for World War I	10	90	-	1.33	29	71	-
	20	80	-	1.60	48	52	-
	30	70	-	1.88	61	39	-
	40	60	-	2.15	71	29	-

Table 6 also shows the location of killed which is implied by each of the possible population exposures. The only evidence available on this point is that, for the day raid on June 13th, 1916, in which the total number killed was 59, 69.5% of the people killed in the City were in the open. This very limited evidence would imply a ratio of death rates equal to about 2.

It must be remembered that while there were no shelters as such in 1914, basement windows were sandbagged and people encouraged to use them. The tubes were also in use to some extent (Jones' "War in the Air", Vol. V, 109, 134). The information which is available suggests that not more than 3% used shelters. On this basis the assumption of no one in shelter will not appreciably affect the results of Table 6.

Bearing in mind that a day-time public warning system was not introduced until June, 1917 and that the enemy was using a new weapon for which the public was not adequately prepared it is not unreasonable to suppose that a high percentage of people were in the open. The Government of the time actually expressed concern at the public coming into the open when warnings sounded (Jones' "War in the Air", Vol. III, p.179).

CD. 1554.

NOTES ON THE OCCUPANCY OF SHELTERS DURING ATTACK BY V.1 WEAPONS ON LONDON - 1944

For the purposes of the assessment to be carried out by the Civil Defence Joint Planning Staff's Working Party on the effects of a heavy air attack on London it was desirable to obtain some basis for estimating the number of people who might be expected to take shelter in the event of attack by V.1 weapons.

No survey having this particular aim had been carried out but some of the data collected during a survey in the Borough of Wandsworth (1944) to determine the effectiveness of various types of shelter against V.1 attack offered some chance of arriving at a reasonable conclusion. The survey extended over the period 18th June 1944 to 28th August 1944, included approximately 100 incidents and involved the examinations of about 200 Morrison shelters, 700 Anderson shelters, 50 brick surface shelters and also some miscellaneous types. Only shelters within 170 ft. of the explosion were examined and the data is confined to such cases.

Of the 100 incidents investigated by the survey team 57 of them gave rise to reports on 428 Anderson shelters which were accepted for present purposes. The reports cover incidents whenever they occurred in the 24 hours.

The number of people to whom these shelters were accessible amounted to 1,471. The numbers who sheltered or remained in the houses were 853 and 618 respectively. Thus the percentage who took shelter was 58%. These figures confirm a previous estimate based on this data although the method of working could not be traced. The previous estimate referred to was expressed as follows:-

Anderson Shelters:-
Occupancy during daylight hours
(0600 hours to 23.00 hours). 48%.
Occupancy during night hours
69%.

Morrison Shelters:-
Occupancy during daylight hours
69%.
Occupancy during night hours
76%.

Underground Stores + Tunnels.
Tube Stations + Shelters. General.

RE/B 62/5/1

....
(R.R. Welch)

10th September 1948

PUBLIC SHELTER OCCUPANCY

A12, ~~SD N 1~~ 2 1

Local Authority	Bunks installed	Occupants On 26/6/44	Occupants On 25/9/44	Public Shelters On dates between 17/12/44 & 7/1/45
		EAST		
Shoreditch	13,903	5,595	1,598	932 (27/12/44)
Dagenham	3,984	1,000	120	24 (17/12/44)
Hackney	13,467	11,624	4,427	1,535 (22/12/44)
East Ham	3,939	2,078	1,073	874 (18/12/44)
Stepney	22,898	16,915	4,762	3,769 (27/12/44)
Wanstead	2,385	1,819	945	484 (1/1/45)
Leyton	7,144	4,894	1,959	1,471 (18/12/44)
	67,720	43,925	14,884	9,089
		NORTH		
Enfield	5,574	1,705	384	64 (20/12/44)
Potters Bar	522	92	63	75 (19/12/44)
Elstree	528	1	nil	nil (27/12/44)
Friern Barnet	553	387	47	105 (20/12/44)
Islington	17,085	18,676	2,770	2,000 (7/1/45)
Hendon	7,677	2,621	364	223 (18/12/44)
	31,939	23,482	3,628	2,467
		WEST		
Staines	1,023	982	88	49 (18/12/44)
Heston	8,178	5,362	987	314 (20/12/44)
	9,201	6,344	1,075	363
		NORTH WEST		
Willesden	9,135	4,257	640	371 (18/12/44)
Ruislip	2,631	936	17	nil (26/12/44)
	11,766	5,193	657	371
		SOUTH		
Woolwich	4,929	3,919	1,413	1,457 (18/12/44)
Wandsworth	21,862	17,701	3,876	1,859 (21/12/44)
Southwark	8,871	21,834	5,450	2,789 (22/12/44)
Chislehurst Caves	10,000	10,000	1,846	1,800 (3/1/44)
	45,662	43,454	12,585	7,905
Total	166,288	122,398	32,829	20,195
	Capacity of bunks used	74%	20%	12%

PUBLIC SHELTERS (CAVES & TUBES) (UNDERGROUND RAILROAD IN LONDON)

SHELTER USAGE

	Before Fly Bombs	At height of Fly Bombs	Present Time	
Bermondsey	823	11,960	4,780	
Deptford	-	4,429	2,489	
Greenwich	447	3,879	1,615	
Lewisham	209	6,745	2,090	
Woolwich	183	4,926	1,509	
Total Group 4	4,215	31,939	12,483	39%
Barking	163	1,769	694	
Chigwell	6	669	140	
Chingford	-	1,075	227	
Dagenham	-	797	66	
East Ham	300	2,251	1,019	
Ilford	522	3,165	853	
Leyton	-	4,600	1,834	
Waltham Holy Cross	Nil	93	8	
Walthamstow	1,400	3,913	1,708	
Wanstead	104	1,868	621	
West Ham	1,300	8,035	2,974	
Total Group 7		28,235	10,144	36%
Finsbury	-	9,500	1,374	
Holborn	159	4,210	417	
St. Pancras	228	12,700	1,791	
Orpington	-	500	100	
Barnes	Nil	400	100	
Malden & Coombe	-	1,100	100	
Croydon	1,500	9,800	2,290	
Wandsworth	1,050	34,381	3,372	
Coulsdon	-	500	65	
Stepney	-	25,000	7,000	
Total Misc.		98,091	16,609	17%
British Museum	106	565	175	
Kentish Town Disused	65	1,280	440	
Southwark Deep	866	6,042	1,435	
West Ham Tunnel		1,813	520	
West Down "		1,200	385	
Gainsboro' "		1,539	574	
Bethnal Green Tunnel	854	4,170	2,150	
Liverpool Street "	672	930	782	
Aldwych	285	1,346	498	
Deep Shelters (Inner) Total		18,885	6,959	37%
Chislehurst Caves		10,000	1,900	
Surrey Tunnels				
(Riddlesdown	850	1,700	500	
(Brighton Road	Nil	600	20	
(Epsom Downs	Nil	400	25	
(Ashley Road	Nil	250	20	
Deep Shelters (Outer) Total		12,950	2,465	19%
Running Tubes	7,716	73,611	15,968	22%
New Tubes	-	10,727	5,998	56%
		84,338	21,966	26%

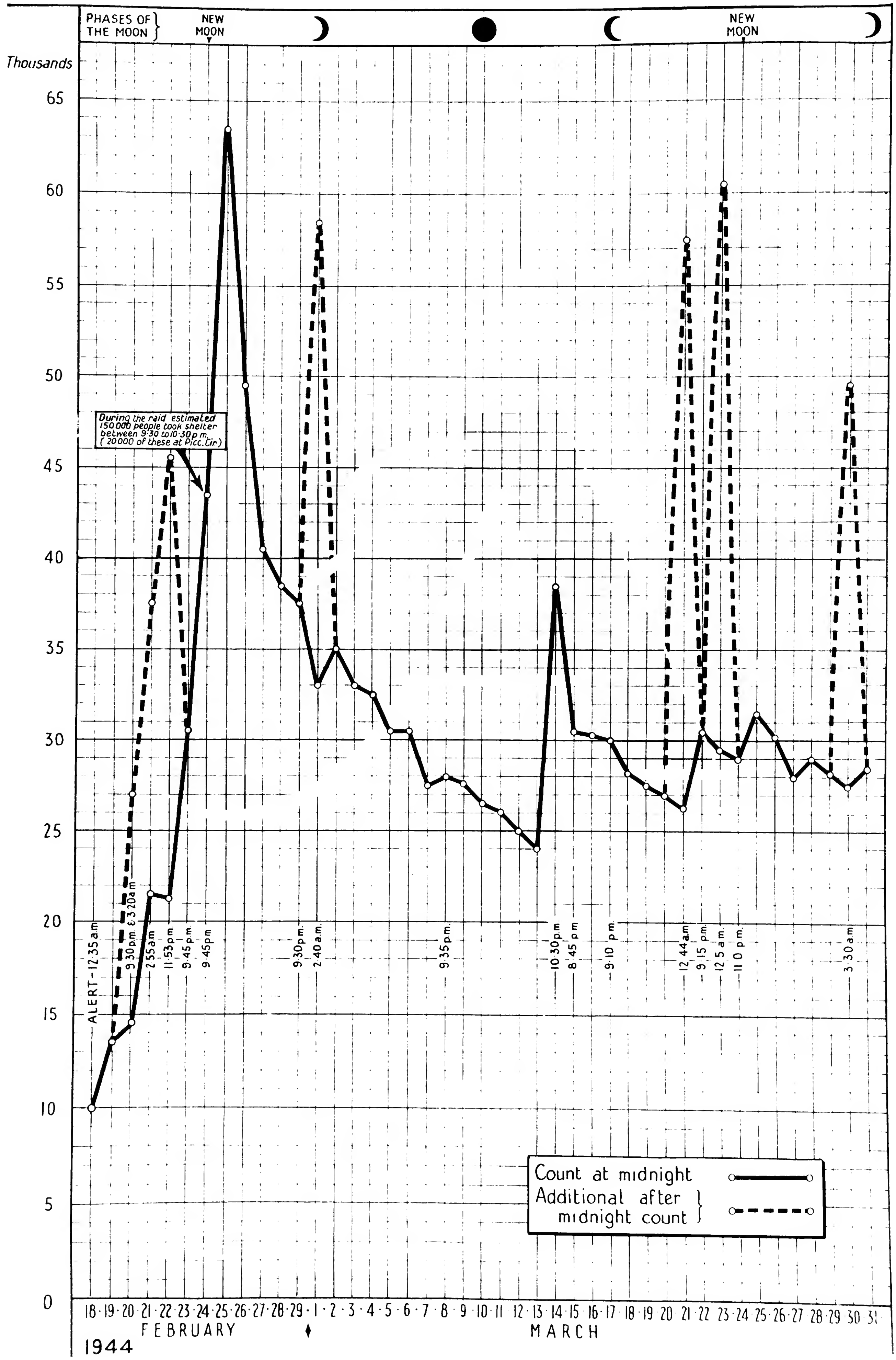
15th November, 1944.
Copied 18/12/45 - LH.

UK National Archives: HO 207/386

NUMBER OF TUBE STATION SHELTERERS
(INCLUDING LIVERPOOL STREET, ALDWYCH AND BETHNAL GREEN)

SECOND BLITZ - FEB. 18th. TO MARCH 31st. 1944

NUMBER OF LONDON ALERTS - 18



~~RESTRICTED~~ For PRO 93/89

3 OCTOBER 1963

HOME OFFICE

SCIENTIFIC ADVISER'S BRANCH

CD/SA 116

RESEARCH ON BLAST EFFECTS IN TUNNELS

With Special Reference to the Use of London Tubes as Shelter

by F. H. Pavry

Summary and Conclusions

The use of the London tube railways as shelter from nuclear weapons raises many problems, and considerable discussion of some aspects has taken place from time to time. But - until the results of the research here described were available - no one was able to say with any certainty whether the tubes would provide relatively safe shelter or not.

This research, consisting of a series of model experiments, has demonstrated that the risk from blast in the tubes would be less than the risks above ground. The results are considered to be consistent enough to provide a good estimate of full-scale conditions, and reliable enough to be used as a basis for Home Office shelter policy regarding the London tube railways.

Introduction

When the Advisory Group on Structural Research for Civil Defence was formed in 1957, the Chairman recommended that a study of the effects of blast on tunnels should be one of the main research projects. The relevant paragraphs of his proposals(1) for a research programme were:-

"In any consideration of tunnels as shelter the crucial problem is the entry of blast, either through existing openings or from a crater formed by a ground-burst bomb. It is particularly important to know if the collapse of a tunnel by earth shock would prevent the blast from entering it, and also whether the collapse would provide a seal against the entry of water from the crater. It is probable that some data could be derived from model experiments using H.E. charges. But it is for consideration whether the results would be so conclusive that the behaviour of full-size tunnels when damaged by megaton weapons could be forecast with the confidence that a major shelter programme would demand."

At the second meeting(2) the Group agreed that model experiments with H.E. charges would be worthwhile, and that the Atomic Weapons Research Establishment (A.W.R.E.) should carry out this research, which has now been accepted by the Advisory Group as successfully completed. A summary record of the progress follows.

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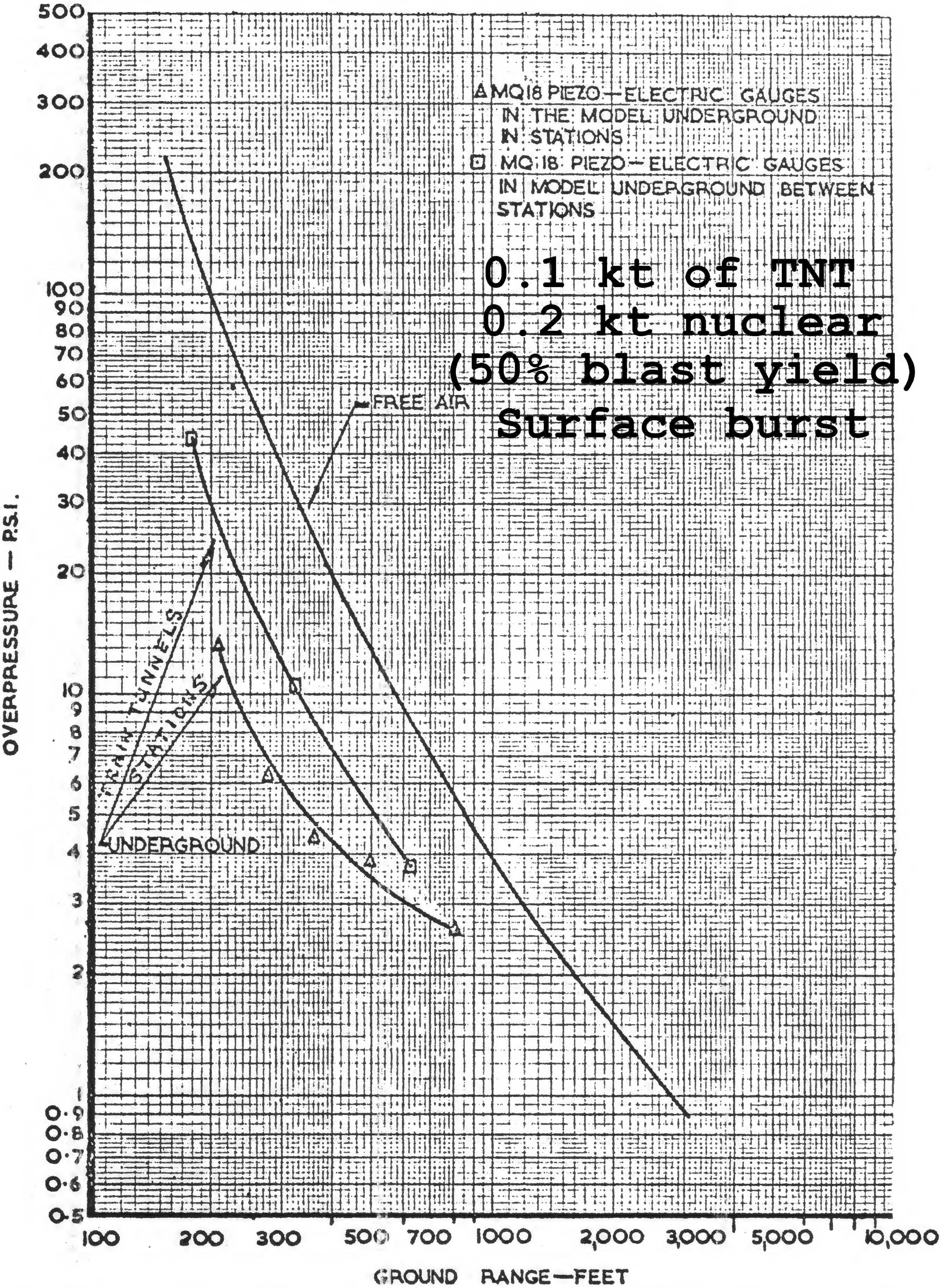
100 ton TNT test on 1000 ft section of London Underground tube at Suffield, Alberta, 3 Aug 1961



Atomic Weapons Research Establishment, "1/40th Scale Experiment to Assess the Effect of Nuclear Blast on the London Underground System", Report AWRE-E2/62, 1962, Figure 30. (National Archives ES 3/57.)

These trials are described in a preliminary report[5] prepared for the Advisory Group by A.W.R.E. It was shown that the blast pressure inside a tunnel system, having openings at intervals to ground level, is less than the pressure at ground level at any distance from the explosion, by a factor of about 3. This reduction in pressure was apparently caused by the station entrances acting as expansion chambers. This observation was of outstanding significance to the consideration of London tubes as shelter.

All previous research on blast in tunnels - and a great amount of work was done on this in the last war - had been conducted with blast entering the open end of a tunnel without side openings. This research had shown that the blast, once it had got into a tunnel, tended to travel great distances without appreciable diminution. This had, therefore, led to the general belief that the London tubes could be death traps rather than shelters.

The more recent research here described showed for the first time that a person sheltering in a tube would be exposed to a blast pressure only about $\frac{1}{3}$ as great as he would be exposed to if he was above ground. (In addition, of course, he would be fully protected from fallout in the tube.)

In fact A.W.R.E. carried out two further tests, with more accurate scaling of station volumes based on more detailed information from the London Transport Executive. A full report on all four tests is in preparation.

These later tests showed that the pressure in station tunnels was only about 1/6th of the ground-level pressure, but that the reduction was not so great in the smaller-diameter train tunnels.

At this stage the Advisory Group were reasonably satisfied that this problem - of blast entry from stations - had been solved. But the other major question of blast entry direct from the crater remained in doubt, on account of the very small scale of the tests to date. Therefore, when the opportunity arose of testing at a really large scale at Suffield, Canada, it was naturally accepted.

Large-Scale Field Test (1/40) at Suffield, Alberta

The test is fully described in an A.W.R.E. report[6]. The decision of the Canadian Defence Research Board to explode very large amounts of high explosive provided a medium for a variety of target-response trials that was welcome at a time when nuclear tests in Australia were suspended. A.W.R.E. used the 100-ton explosion in 1961 to test, among other items, the model length of the London tube, at 1/40th scale, that had already been tested at 1/117 scale.

Blast Entry from Stations

There was remarkable agreement with the 1/117th scale trials: "maximum overpressure in the train tunnels was of the order of $\frac{1}{3}$rd the corresponding peak shock overpressure in the incident blast. The pressures in the stations were about 1/6th those in the corresponding incident blast .... ". In comparing the results at the two scales it was noted that the pressures in the train tunnels (between stations) was higher at Suffield than at the smaller scale; this may, the report suggests, have been due to some blast entry from the crater at Suffield.

Blast Entry from the Crater

There may - as has just been noted - have been some entry of blast at the crater. But the all-important fact is that it was nowhere enough to bring the pressure in the tunnel up to more than a $\frac{1}{3}$rd of the free-air pressure (see fig. 30 reproduced, and attached to this note.) From this, and from a detailed study of tunnel rings ejected by the explosion over a wide area, it can be concluded that the instantaneous crushing of the tube near the crater sealed it against the entry of any significant blast pressure.

Air Flow in Stations

The Report indicates that there would be turbulence generated by blast entry at stations and that there would be a danger to occupants there, on account of blast "windage" acting on them and on missiles that could injure them. This danger would be less in the train tunnels between stations.

Conclusion

The Advisory Group discussed the Suffield Test on tunnels on Nov. 1st 1962, and concluded that model experiments have successfully demonstrated that the risks from blast inside the London tubes would be less than above ground. The Group considered that the results obtained were consistent enough to provide as good an estimate of full-scale effects from megaton weapons as was likely to be obtainable, and that the Chairman could advise the Home Office confidently on the basis of these results. The Group accepted that there would be a risk of casualty-producing air flow in stations, but decided to defer a decision on whether further research on this problem would be profitable. The Chairman said that he would first convey the results of the completed research to the Shelter Division of the Home Office before asking the Group whether it was worth studying this remaining, but less important, problem.

3rd October, 1963.

References

(1) Advisory Group on Structural Research for Civil Defence

Note by Chairman on the Structural Research Programme for Shelters. SAB/SG(57)6. (Restricted)

(2) Notes of Meeting on 15th May 1957. SAB/SG(57)2nd Minutes (Confidential)

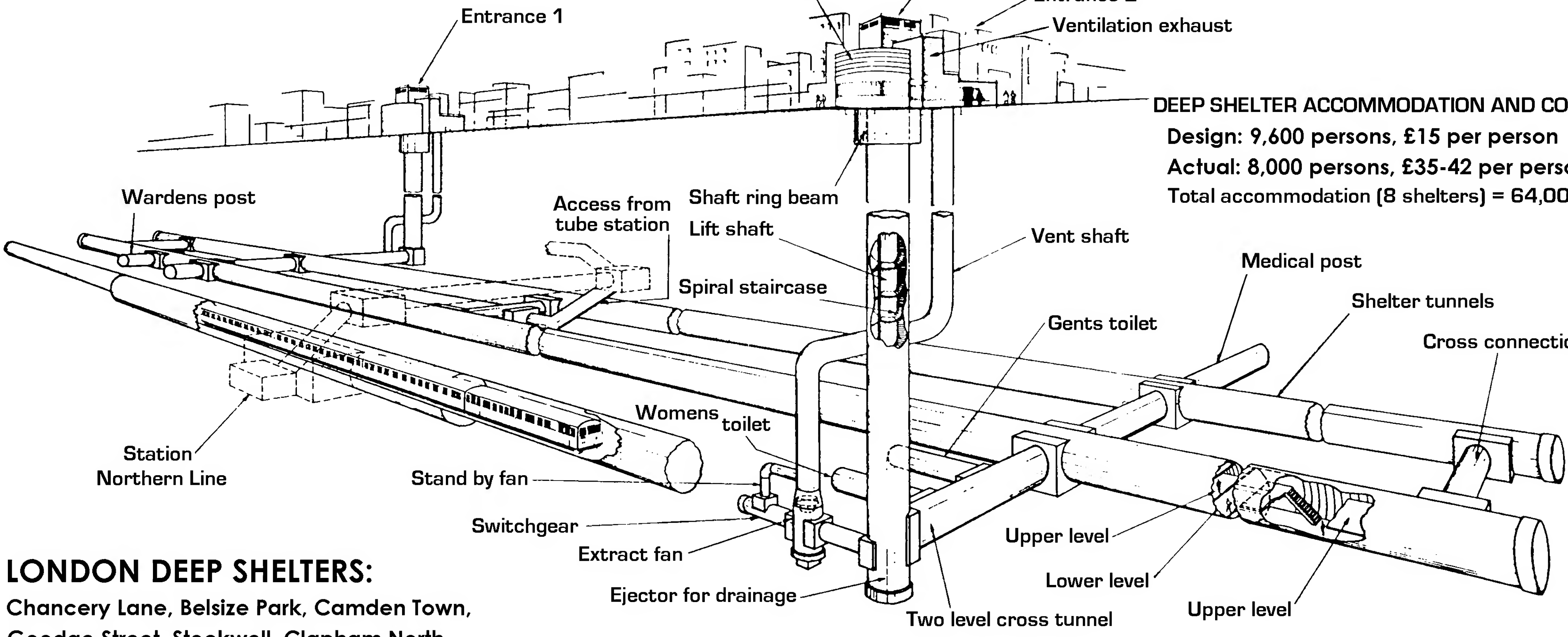
(3) The Entry of Air Blast from Craters into Tunnels. A.W.R.E. Report E1/59 (Official Use Only)

(4) The Effect of Tunnel Blockage on Shock Waves .... SAB/SG(58)6 (Confidential)

(5) Model Experiments on the Entry of Blast into the London Underground System, Interim Report on Rounds 1 and 2. SAB/SG(59)4 (Confidential)

(6) 1/40th Scale Experiment to Assess the Effect of Nuclear Blast on the London Underground System. A.W.R.E. Report E2/62. (Official Use Only.)

UK National Archives: WORK 95/9, 1989-1997,
"Clapham South Deep Tube Shelter: Management"



DEEP SHELTER ACCOMMODATION AND COST

Design: 9,600 persons, £15 per person

Actual: 8,000 persons, £35-42 per person

Total accommodation (8 shelters) = 64,000

LONDON DEEP SHELTERS:

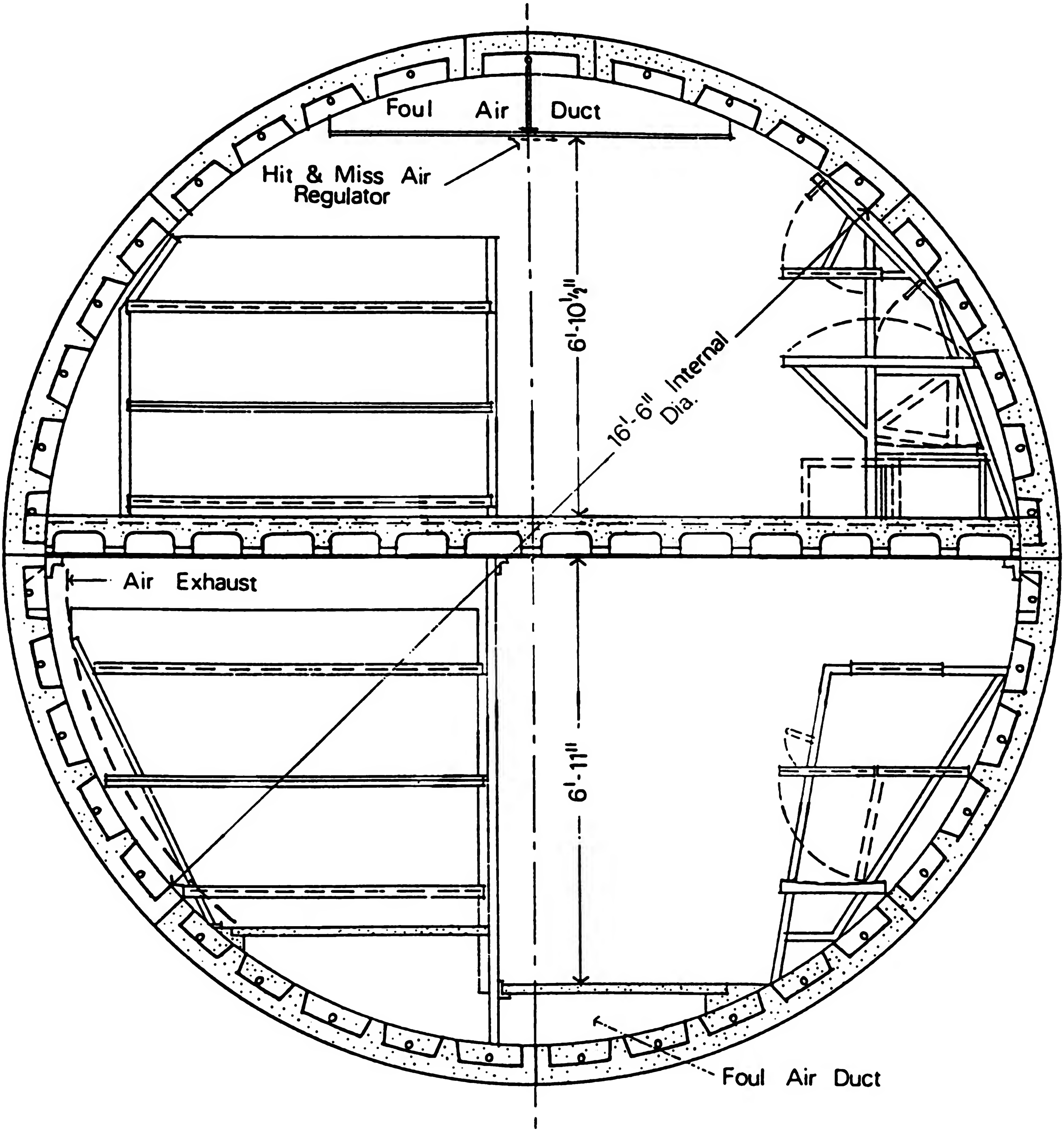
Chancery Lane, Belsize Park, Camden Town, Goodge Street, Stockwell, Clapham North, Clapham Common, Clapham South (government air raid shelters, built in 1940-2)
Building began on 27 November 1940

Deep shelters were used by public from July 1944 after V1 attacks began on 13 June 1944 (V2s began on 8 September)

FIG. 1

MOTT MAY AND ANDERSON
CONSULTING ENGINEERS, LONDON

UK National Archives: WORK 95/9, 1989-1997,
"Clapham South Deep Tube Shelter: Management"



SECTION OF SHELTER TUNNEL

DOMESTIC NUCLEAR SHELTERS

TECHNICAL GUIDANCE

A HOME OFFICE GUIDE

Government bookshops
49 High Holborn, London WC1V 6HB
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Brazennose Street, Manchester M60 8AS
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Government publications are also available through booksellers

Prepared by the Home Office and the Central Office of Information 1981
Printed in England for Her Majesty's Stationery Office by Hobbs the Printers of Southampton

ISBN 0 11 340777 7 (2462) Dd717557 C40 1/82 G381

Introduction

This manual of technical guidance on the design of domestic nuclear shelters has been prepared by a working group set up by the Emergency Services Division of the Home Office. The working group was asked to consider designs of nuclear shelters which could be made available to members of the public in the United Kingdom who might wish to purchase and install shelters for the use of themselves and their families.

The working group realised that the range of designs which it might produce would not be exhaustive. However, it was aware of the need to give technical guidance to professional engineers to assist them in producing reliable shelter designs. Thus the first three chapters of this book are written to give such guidance.

The other four chapters of the book give detailed designs of five shelters. These five cover a range of types which are applicable to different sorts of houses; they also cover a wide price range. These designs are not intended to be exhaustive, and as explained in the text, the working group is already giving attention to other designs, particularly those which might be incorporated into existing or new houses and also underground shelters of shapes other than box-like and using materials other than concrete. It is planned to publish details of this work at a later date.

The members of the working group are:

Mr J C Cotterill, *Chairman*	Scientific Advisory Branch, Home Office
Dr J R Stealey	Scientific Advisory Branch, Home Office
Mr A Lindfield	Scientific Advisory Branch, Home Office
Mr K A Day	F6 Division, Home Office
Mr R W T Haines, C Eng	Directorate of Works, Home Office
Mr H G S Banks, C Eng	Directorate of Works, Home Office
Mr M Connell, C Eng	Directorate of Civil Engineering Services Property Services Agency, Department of Environment
Mr S Bell, C Eng	Directorate of Civil Engineering Services Property Services Agency, Department of Environment
Mr S England, C Eng	Directorate of Mechanical and Electrical Engineering Services Property Services Agency, Department of Environment
Mr I Leys	Atomic Weapons Research Establishment, Ministry of Defence Foulness
Major I C T Ingall	HQ United Kingdom Land Forces Wilton, Wilts.
Mr R Million, *Secretary*	F6 Division, Home Office

Any enquiries concerning this manual should be addressed to the Home Office, F6 Division, and not to individual members of the working group.

To obtain some protection from the heat it is necessary to move out of the direct path of the rays from the fireball; any kind of shade will be of some value. In shelter design, any materials affording protection against ionising radiation or blast will give more than adequate protection against the heat. However it is important to ensure that no exposed parts of the shelter (such as the facings of doors) are made of flammable materials. In the case of shelters made from plastic materials such as GRP (glass reinforced plastic) it is essential that no surfaces should be exposed to the heat pulse. It is unlikely that such plastic materials would catch fire, but they may melt or distort. Since the blast wave follows the heat pulse, such distorted areas may result in lowered blast resistance.

It is considered unlikely that the heat flash from a nuclear explosion would give rise to fire-storms. In the last war, fire-storms were caused in the old city of Hamburg as a result of heavy incendiary attacks and at Hiroshima but not at Nagasaki. A close study of these cities and of German cities where fire-storms did and did not occur revealed several interesting features. A fire-storm occurred only in an area of several square miles, heavily built up with buildings containing plenty of combustible material and where at least every other building in the area had been set alight. It is not considered that the initial density of fires, equivalent to one in every other building, would be caused by a nuclear explosion over a British city. Studies have shown that due to shielding, a much smaller proportion of buildings than this would be exposed to the heat flash. Moreover, the buildings in the centres of most British cities are now more fire-resistant and more widely spaced than they were 30 to 40 years ago. This low risk of fire-storms would be reduced still further by the control of small initial and secondary fires.

2. Shielding for INR

INR has greater energy and penetration than the radiation from fallout. The intensity of both INR and fallout radiation are reduced in proportion to the density of the shielding material. This can be expressed in terms of the 'half-value thickness' which is the thickness of a particular shielding material required to halve the radiation dose-rate. The approximate half-value thicknesses of some shielding materials against INR are given in Fig. 8.

Fig. 8 ***Half-value thicknesses of shielding materials***

	Against INR mm	(inches)	Against fallout radiation mm	(inches)
Steel	38	(1.5)	18	(0.7)
Concrete	152	(6.0)	56	(2.2)
Earth	190	(7.5)	84	(3.3)
Water	330	(13.0)	122	(4.8)
Brickwork	157	(6.2)	71	(2.8)

3. Slant incidence of INR

Most of the INR from a nuclear explosion arriving at a given point comes in a direct line from the fireball. There is a certain amount of scattering known as 'skyshine' which means that some initial gamma radiation might be received by a person shielded by a barrier from the light and heat flash (see Fig. 10). The amount of scattering of initial gamma radiation depends upon a number of factors, but probably amounts to about 10 per cent of that in the main beam.

Chapter 5
Indoor kit shelter design

"Morrison shelter" of 1941 (indoor steel table shelter)

General

This chapter gives information about an indoor shelter suitable for erection in homes that have basements or rooms that can be converted into a fallout room. It can be used as the 'inner refuge' referred to in the Home Office booklet *Protect and Survive* and anybody considering purchasing or using such a shelter should read *Protect and Survive* and be totally familiar with its contents.

Fig. 65 ***Location of shelter***

Indoor kit-type shelter

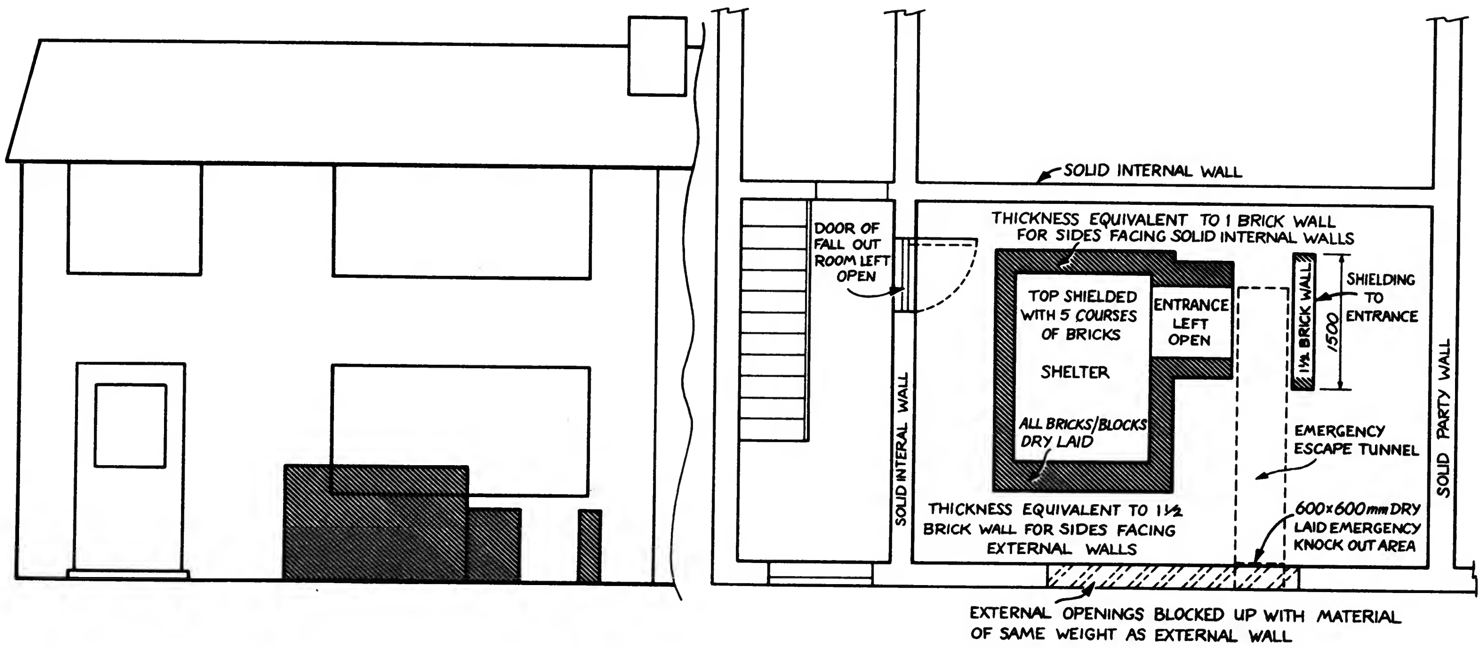


Fig. 67 ***Shelter surrounded with sandbags***

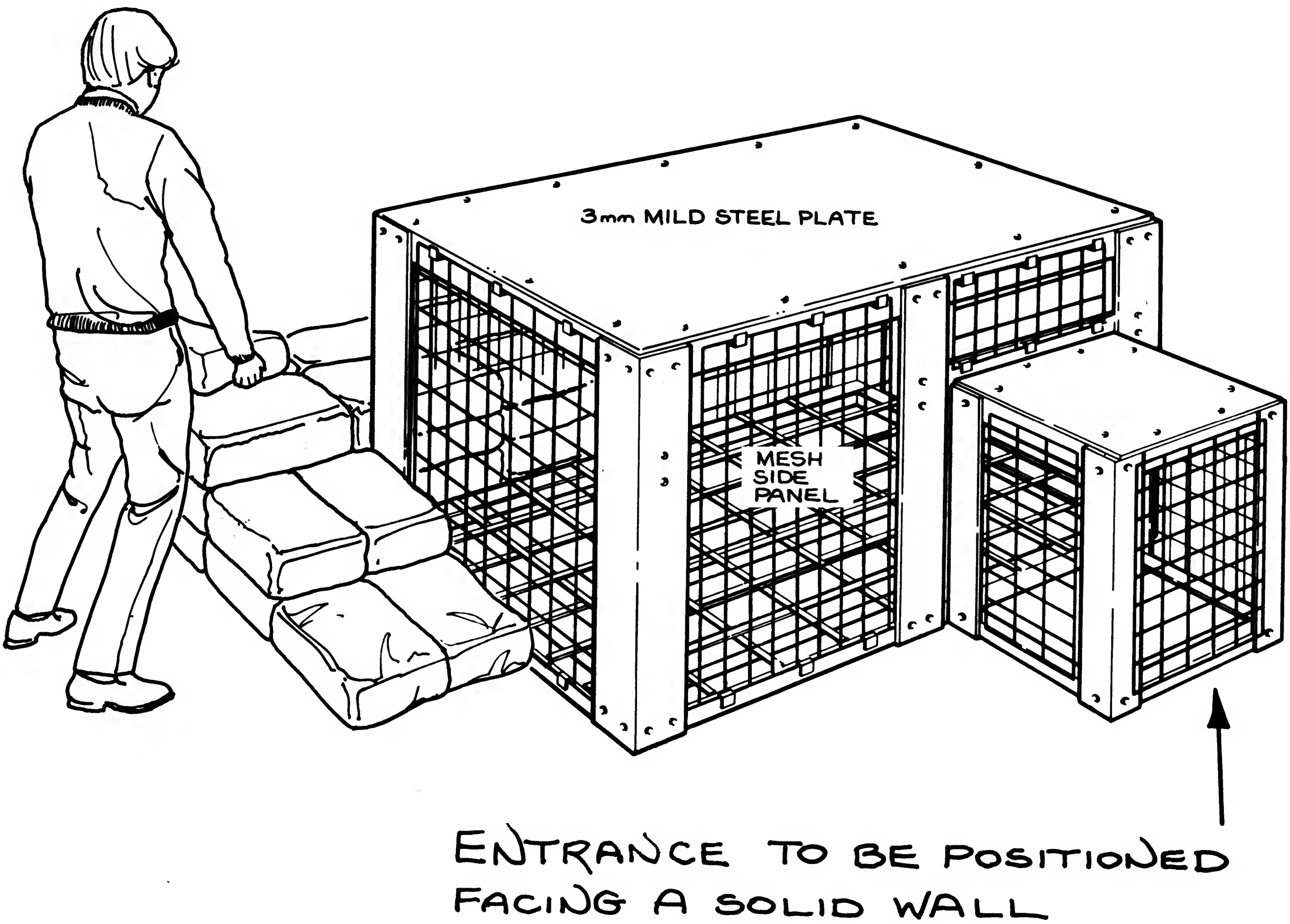


Fig. 12 ***Protective factors of various buildings against initial gamma, neutron and fallout gamma radiation***

Structure	Initial gamma	Neutrons	Fallout gamma
1 metre underground	250–500	100–500	5000
Shelter partly above ground: with 600 mm earth 900 mm earth	 15–35 50–150	 12–50 20–100	 50–200 200–1000

Considerations arising from the probable attack pattern

In section 1.1.1 reference was made to the fact that an expected attack pattern on the United Kingdom might use 200 megatons on about 80 targets. If we now make an assumption that this attack would be in the form of 100 weapons of 1 MT airbursts and 100 weapons of 1 MT groundbursts we can use the information given in Fig. 6 to indicate the probability of areas being subject to various effects.

On this assumption, we should find that about 2.2 per cent of the land area of the UK would be subject to overpressures in the 'A' ring of 77 kPa (11 psi) and above about 1.8 per cent would be subject to overpressures of between 42 and 77 kPa (6-11 psi) in the 'B' ring and about 10 per cent of the land area would be subject to overpressures of between 10 and 42 kPa (1.5 to 6 psi). The rest of the land area, about 85 per cent, would be subject to blast in the D ring of 5 to 10 kPa (0.75 to 1.5 psi) or to no blast at all. Blast effects in the D ring will cause minor damage to buildings and no lethalities. It is impossible to determine the extent of the total D ring areas since many of these will overlap from adjacent bombs. Any part of the country might be subject to radiation from fallout.

Further comments on Home Office shelter designs

Chapters 4 to 7 of this book give details of the Home Office shelter designs and, where appropriate, detailed instructions for construction. It will be useful however to discuss here the reasons why this range of shelters has been chosen. Other designs are under consideration and it is planned to make details of these available later.

Limitations related to houses and gardens

In making recommendations for shelters it has been necessary to keep in mind the varying needs governed by the types of housing in the United Kingdom. Very roughly housing can be divided into the following groups:

a. Detached or semi-detached houses where there is appropriate access to the rear garden. (About 34%).
b. Semi-detached and terrace housing where there is no access to the rear garden, except through the house. (About 20%).
c. Houses with no rear garden. Such houses usually have a passage between the rows of terraces with access to a back yard. (About 25%).
d. Multi-storey blocks of flats. (About 12%).
e. Flats resulting from the conversion of 2, 3 and 4 storey houses. There is usually some garden space available attached to such property. (About 7%).
f. Bungalows, usually with accessible gardens. (About 2%).
g. Caravans.

Proceedings of the Symposium
held at Washington, D. C.
April 19-23, 1965 by the
Subcommittee on Protective Structures,
Advisory Committee on Civil Defense,
National Academy of Sciences—
National Research Council

Protective Structures

for

CIVILIAN POPULATIONS

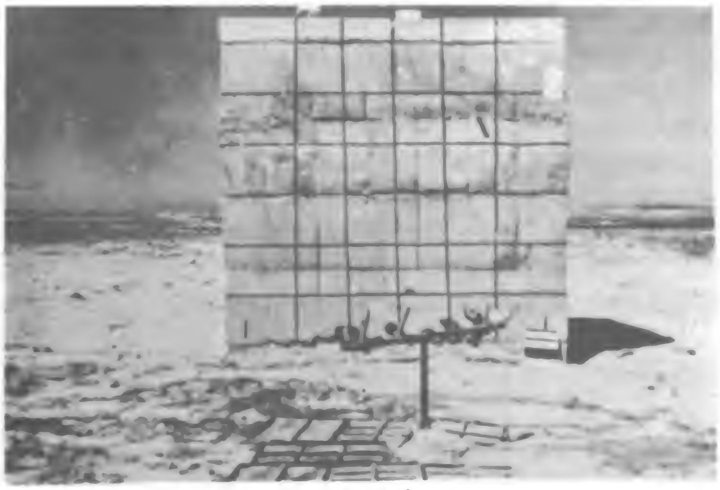
1966

MODEL ANALYSIS

Mr. Ivor Ll. DAVIES
Suffield Experimental Station
Canadian Defense Research Board
Ralston, Alberta, Canada

Nuclear-Weapon Tests

In 1952 we fired our first nuclear device, effectively a "nominal" weapon, at Monte Bello, off northwest Australia. To the blast loading from this weapon we exposed a number of reinforced-concrete cubicle structures that had been designed for the dynamic loading conditions, and for which we made the best analysis of response we were competent to make at that time. Our estimates of effects were really a dismal failure. The structures were placed at pressure levels of 30, 10, and 6 psi, where we expected them to be destroyed, heavily damaged with some petaling of the front face, and extensively cracked, respectively. In fact, the front face of the cubicle at 30 psi was broken inwards; failure had occurred along both diagonals, and the four triangular petals had been pushed in. At the 10-psi level, where we had three cubicles, each with a different wall thickness (6, 9, and 12 in.), we observed only light cracking in the front face of that cubicle with the least thick wall (6 in.). The other two structures were apparently undamaged, as was the single structure at the 6-psi level.



10 p.s.i.

34 p.s.i.

Dynamic tests, Monte Bello cubicles.

In 1957, the first proposals were made for the construction of the underground car park in Hyde Park in London. The Home Office was interested in this project since, in an emergency, the structure could be used as a shelter. Consequently a request was made to us at Atomic Weapons Research Establishment (A.W.R.E.) to design a structure that would be resistant to a blast loading of about 50 psi, and to test our design on the model scale.

Using the various load-deformation curves obtained in this test, an estimate was made of the response of the structure to blast loading. Of particular interest was the possible effect of 100 tons of TNT, the first 100-ton trial at Suffield in Alberta.

A total of seven more models was made; six were shipped to Canada and placed with the top surface of the roof flush with the ground and at positions where peak pressures of 100, 80, 70, 60, 50, and 40 psi were expected. The seventh model was kept in England for static testing at about the time of firing. The results were not as expected. In the field, the four models farthest from the charge were apparently undamaged; we could see no cracking with the eye, nor did soaking the models with water reveal more than a few hair cracks. The model nearest the charge was lightly cracked in the roof panels and beams, and one of the columns showed slight spalling at the head. This model had been exposed to a peak pressure of 110 psi.

THE PROTECTION AGAINST FALLOUT RADIATION AFFORDED BY CORE SHELTERS IN A TYPICAL BRITISH HOUSE

Daniel T. Jones
Scientific Adviser, Home Office, London

Protective Factors in a Sample of British Houses (Windows Blocked)

Protective Factor	Percentage of Houses
< 25	36%
25-39	28%
40-100	29%
> 100	7%

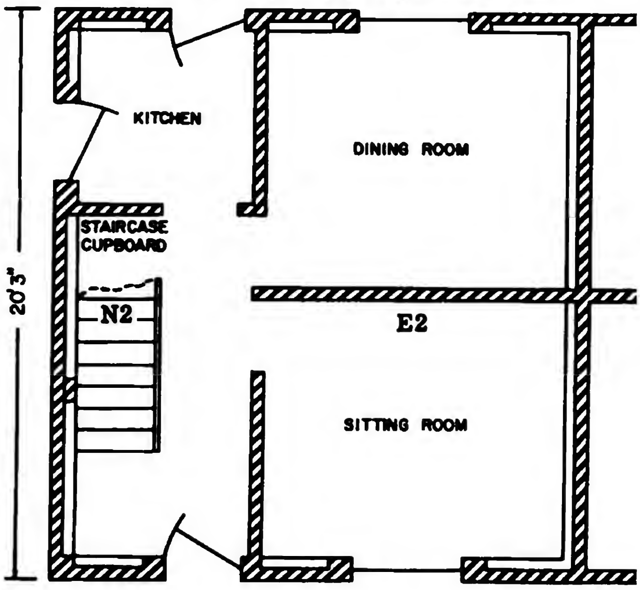
"A very much improved protection could be obtained by constructing a shelter core. This means a small, thick-walled shelter built preferably inside the fallout room itself, in which to spend the first critical hours when the radiation from fallout would be most dangerous."(1)

The full-scale experiments were carried out at the Civil Defense School at Falfield Park.(2)

In the staircase construction, the shelter consisted of the cupboard under the stairs, sandbags being placed on treads above and at the sides.

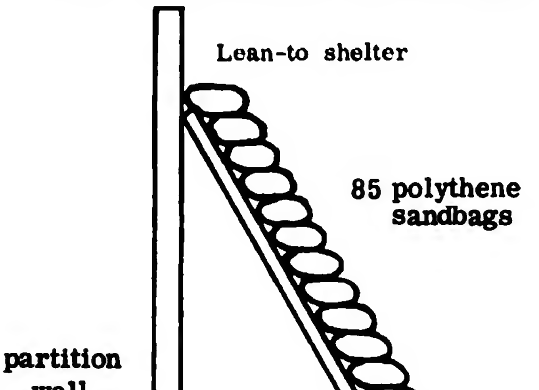
A 93 curies cobalt-60 source was used.

1. Six sandbags per tread, and a double layer on the small top landing. 96 sandbags were used.
2. As (1), together with a 4-ft-high wall of sandbags along the external north wall. 160 sandbags were used.
3. As (2), together with 4-ft-high walls of sandbags along the kitchen/cupboard partition wall and along the passage partition. 220 sandbags were used.



9 in. brick walls. The windows and doors were not blocked	Position	contribution r/hr/c/ft^2 Ground	Roof	Protective Factor
House only	E2	15.0	8.4	21
Lean-to	E2	10.4	2.4	39
Staircase cupboard:				
Stairs only sandbagged	N2	29.2	5.3	14
Stairs and outer wall sandbagged	N2	16.4	4.6	24
Stairs, outer wall, kitchen wall and corridor partition sandbagged	N2	8.8	1.8	47

sandbags 24 in. x 12 in. when empty; 16 in. x 9 in. x 4 in. when filled with 25 lb of sand.



floor area 21 sq ft.

1. Civil Defence Handbook No. 10, HMSO, 1963.
2. Perryman, A. D., Home Office Report CD/SA 117.

BLAST AND OTHER THREATS

Harold Brode
The RAND Corporation, Santa Monica, California

Chemical High-Explosive Weapons

As in past aerial warfare, bombs and missiles carrying chemical explosives to targets are capable of extensive damage only when delivered in large numbers and with high accuracy.

Biological Warfare

Most biological agents are inexpensive to produce; their effective dissemination over hostile territories remains the chief deterrent to their effective employment. Twenty square miles is about the area that can be effectively covered by a single aircraft; large area coverage presents a task for vast fleets of fairly vulnerable planes flying tight patterns at modest or low altitudes. While agents vary in virulence and in their biologic decay rate, most are quite perishable in normal open-air environments. Since shelter and simple prophylactic measures can be quite effective against biological agents, there is less likelihood of the use of biological warfare on a wholesale basis against a nation, and more chance of limited employment on population concentrations —perhaps by covert delivery, since shelters with adequate filtering could insure rather complete protection to those inside.

Chemical Weapons

Chemical weapons, like biological weapons, are relatively inexpensive to create, but face nearly insurmountable logistics problems on delivery. Although chemical agents produce casualties more rapidly, the greater amounts of material to deliver seriously limit the likelihood of their large-scale deployment. Furthermore, chemical research does not hold promise of the development of significantly more toxic chemicals for future use.

Radiological Weapons

The advantages of such modifications are much less real than apparent. In all weapons delivered by missiles, minimizing the payload and total weight is very important. If the total payload is not to be increased, then the inclusion of inert material to be activated by neutrons must lead to reductions in the explosive yield. If all the weight is devoted to nuclear explosives, then more fission-fragment activity can be created, and it is the net difference in activity that must be balanced against the loss of explosive yield. As it turns out, a fission explosion is a most efficient generator of activity, and greater total doses are not achieved by injecting special inert materials to be activated.

Perret, W.R., Ground Motion Studies at High Incident Overpressure, The Sandia Corporation, Operation PLUMBBOB, WT-1405, for Defense Atomic Support Agency Field Command, June 1960.

The Neutron Bomb

The neutron bomb, so called because of the deliberate effort to maximize the effectiveness of the neutrons, would necessarily be limited to rather small yields—yields at which the neutron absorption in air does not reduce the doses to a point at which blast and thermal effects are dominant. The use of small yields against large-area targets again runs into the delivery problems faced by chemical agents and explosives, and larger yields in fewer packages pose a less stringent problem for delivery systems in most applications. In the unlikely event that an enemy desired to minimize blast and thermal damage and to create little local fallout but still kill the populace, it would be necessary to use large numbers of carefully placed neutron-producing weapons burst high enough to avoid blast damage on the ground, but low enough to get the neutrons down. In this case, however, adequate radiation shielding for the people would leave the city unscathed and demonstrate the attack to be futile.

The thermal radiation from a surface burst is expected to be less than half of that from an air burst, both because the radiating fireball surface is truncated and because the hot interior is partially quenched by the megatons of injected crater material.

SUPERSEISMIC GROUND-SHOCK MAXIMA (AT 5-FT DEPTH)

Vertical acceleration: $\alpha_{vm} \simeq 340\,\Delta P_s/C_L \pm 30$ per cent. Here acceleration is measured in g's and overpressure (ΔP_s) in pounds per square inch. An empirical refinement requires C_L to be defined as the seismic velocity (in feet per second) for rock, but as three fourths of the seismic velocity for soil.

OUTRUNNING GROUND-SHOCK MAXIMA (AT ~10-FT DEPTH)

Vertical acceleration: $\alpha_{vm} \simeq 2 \times 10^5/C_L r^2$ + factor 4 or -factor 2. Acceleration is measured in g's, and r is the scaled radial distance—i.e., $r = R/W^{1/3}$ kft/(mt)$^{1/3}$.

Data taken on a low air-burst shot in Nevada indicate an exponential decay of maximum displacement with depth. For the particular case of a burst of ~ 40 kt at 700 ft, some measurements were made as deep as 200 ft below the surface of Frenchman Flat, a dry lake bed, which led to the following approximate decay law, according to Perret.

$\delta = \delta_0 \exp(-0.017D)$,

where δ represents the maximum vertical displacement induced at depth D, δ_0 is the maximum displacement at the surface, and D is the depth in feet.

Foreword

If the country were ever faced with an immediate threat of nuclear war, a copy of this booklet would be distributed to every household as part of a public information campaign which would include announcements on television and radio and in the press. The booklet has been designed for free and general distribution in that event. It is being placed on sale now for those who wish to know what they would be advised to do at such a time.

May 1980

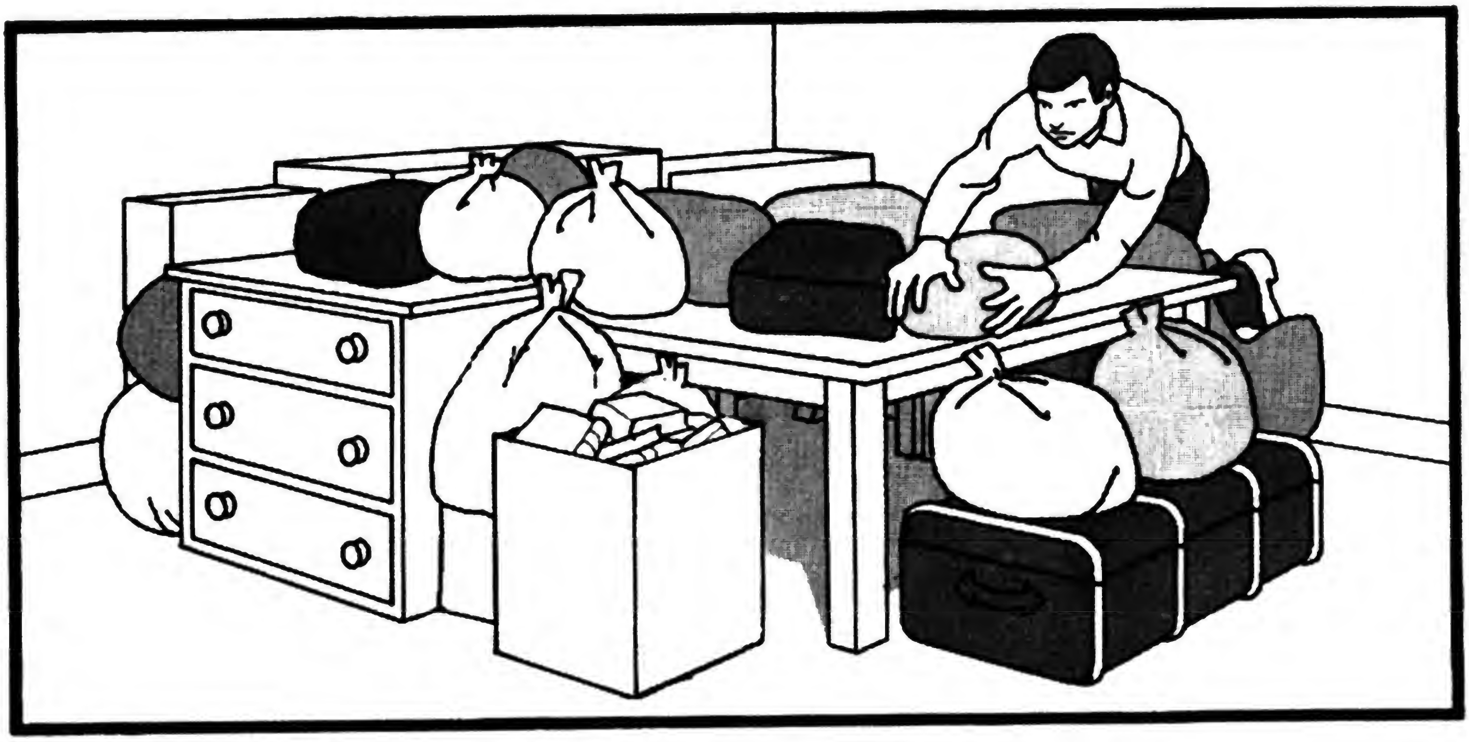
Protect and Survive
ISBN 0 11 3407289

If Britain is attacked by nuclear bombs or by missiles, we do not know what targets will be chosen or how severe the assault will be.

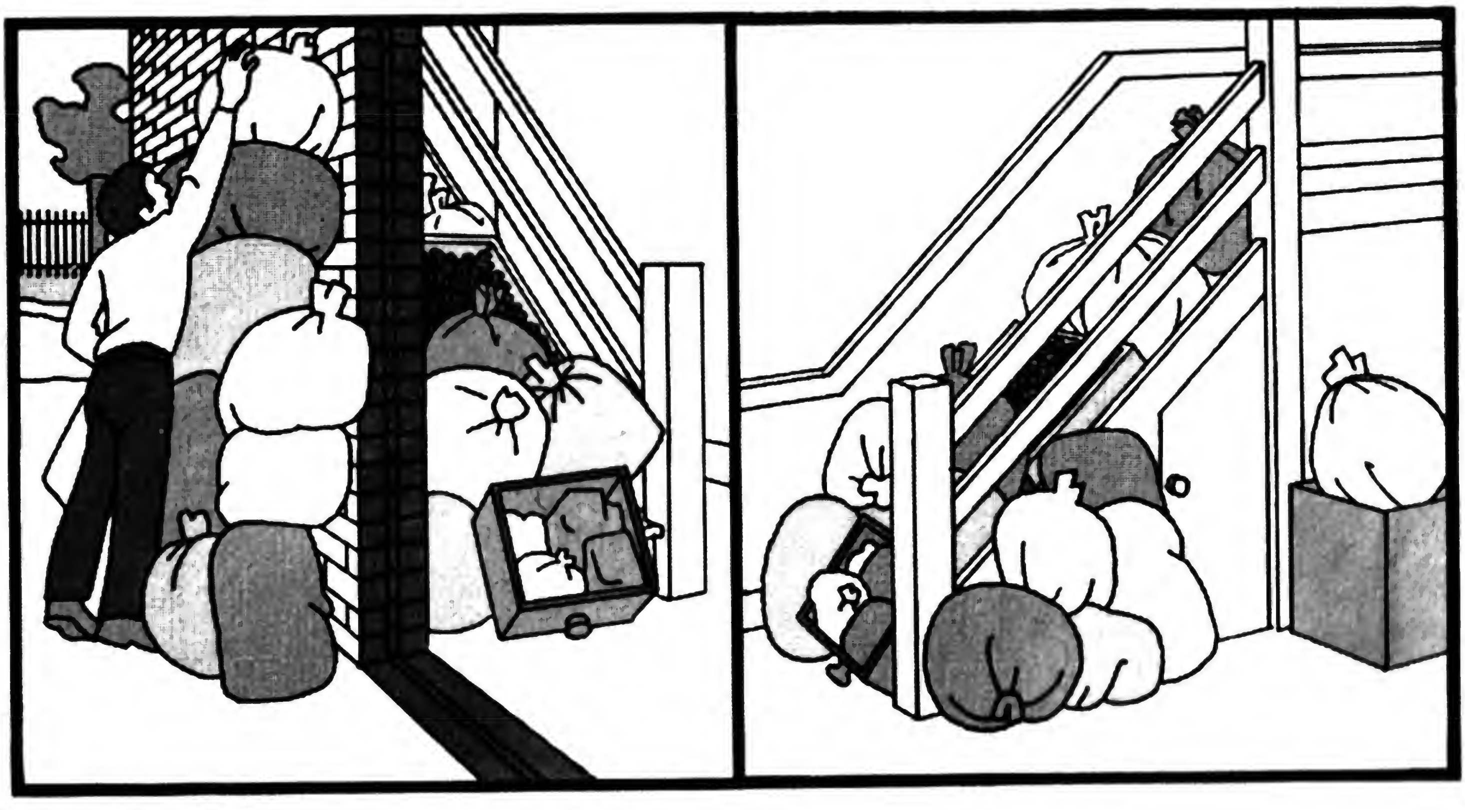
If nuclear weapons are used on a large scale, those of us living in the country areas might be exposed to as great a risk as those in the towns. The radioactive dust, falling where the wind blows it, will bring the most widespread dangers of all. No part of the United Kingdom can be considered safe from both the direct effects of the weapons and the resultant fall-out.

The dangers which you and your family will face in this situation can be reduced if you do as this booklet describes.

Use tables if they are large enough to provide you all with shelter. Surround them and cover them with heavy furniture filled with sand, earth, books or clothing.



Use the cupboard under the stairs if it is in your fall-out room. Put bags of earth or sand on the stairs and along the wall of the cupboard. If the stairs are on an outside wall, strengthen the wall outside in the same way to a height of six feet.



What to do after the Attack:

After a nuclear attack, there will be a short period before fall-out starts to descend. Use this time to do essential tasks. This is what you should do.

Do not smoke.

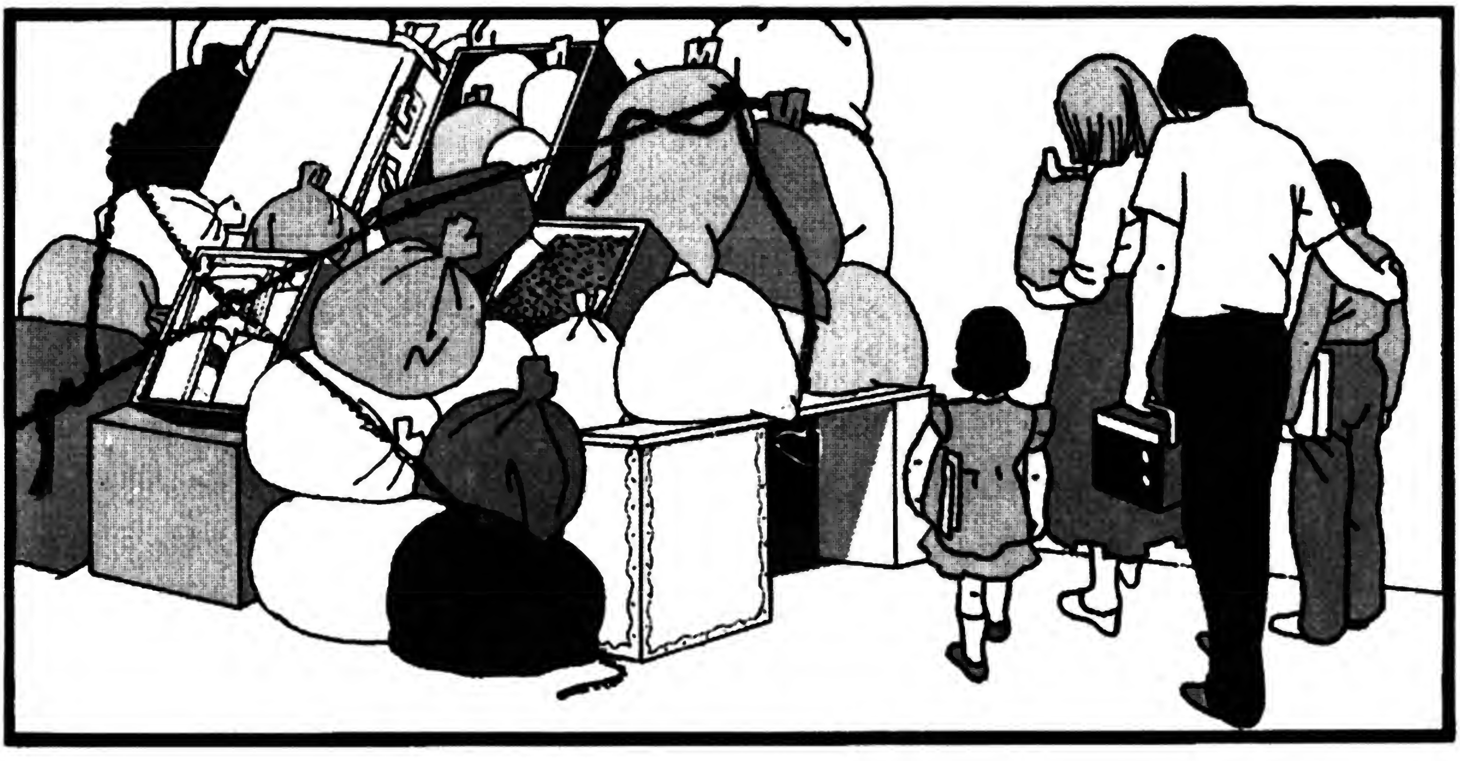
Check that gas, electricity and other fuel supplies and all pilot lights *are* turned off.

Go round the house and put out any small fires using mains water if you can.

If anyone's clothing catches fire, lay them on the floor and roll them in a blanket, rug or thick coat.

If there is structural damage from the attack you may have some time before a fall-out warning to do minor jobs to keep out the weather – using curtains or sheets to cover broken windows or holes.

If you are out of doors, take the nearest and best available cover as quickly as possible, wiping all the dust you can from your skin and clothing at the entrance to the building in which you shelter.



SEPTEMBER 1964

HOME OFFICE

CD/SA 121

SCIENTIFIC ADVISER'S BRANCH

IGNITION AND FIRE SPREAD IN URBAN AREAS FOLLOWING A NUCLEAR ATTACK

G. R. Stanbury

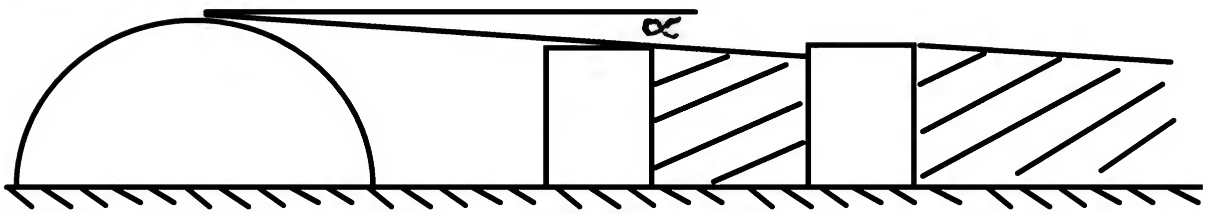
INITIAL FIRE INCIDENCE

For a 1 MT groundburst bomb the height of the top of the fireball above ground is about 0.72 miles. Because this distance is large compared with the height of most buildings, the exposed upper floors do actually see a large part of the fireball and not just the top of it, but in assuming that the radiation is just as intense from the top as from the middle we were overestimating the fire risk.

On the above basis the following table gives the number of exposed upper floors (to the nearest ½ floor) for a range of distances from the explosion and a range of street widths.

Effect of Shielding: Estimation of the number of exposed floors

Assuming that buildings on opposite sides of a street which is receiving heat radiation from a direction perpendicular to its length are of the same height



Distance from explosion miles	Angle of arrival α°	$\tan\alpha$	Width of street (units of 10 ft.)						
			2	3	4	5	6	7	8
1	35	.72	1.5	2	3	3.5	4.5	5	6
1½	26	.48	1	1.5	2	2.5	3	3.5	4
2	20	.36	.5	1	1.5	2	2	2.5	3
3	13½	.24	.5	.5	1	1	1.5	1.5	2
4	10	.18	.5	.5	.5	1	1	1.5	1.5
5	8	.15	.5	.5	.5	.5	1	1	1

we take the average depth of a floor to be 10 ft.

Angle between heat flash and street (degrees)	90-75	75-60	60-45	45-30	30-15	15-0
Proportion of heat flash entering windows %	99	92.5	80	60	40	14

SPREAD OF FIRE

From last war experience of mass fire raids in Germany it was concluded that the overall spread factor was about 2; i.e. about twice as many buildings were destroyed by fire as were actually set alight by incendiary bombs

Number of fires started per square mile in the fire-storm raid on Hamburg, 27th/28th July, 1943

Bombs dropped

102 tons H.E.

88 tons I.B.

48 tons, 4 lb. magnesium

40 tons, 30 lb. gel.

27,000 bombs

3,000 bombs

8,000 bombs on buildings

900 bombs on buildings

1,600 fires

800 fires

100 fires

2,500 fires in 6,000 buildings

However, the important thing to note is that the total number of fires started in each square mile (2,500) was nearly half that of the total number of buildings; in other words, almost every other building was set on fire during the raid itself. When this happened no fire-fighting organisation, however efficient could hope to prevent the fires from joining together and engulfing the whole area.

When the figure of 1 in 2 for the German fire storms is compared with the figures for initial fire incidence of $\sim$ 1 in 15 to 30 obtained in the Birmingham and Liverpool studies it can only be concluded that a nuclear explosion could not possibly produce a fire storm.

Fire situation from 1,499 fly bombs in the built-up part of the London Region

WWII V1 high explosives (1 ton TNT warhead) (cruise missiles)

Where dropped	Number of fly bombs	Fly Bombs Caused				
		No fire	Small fire	Medium fire	Serious fire	Major fire
City	119 ~~199~~	47	49	17	4	2
West-End	33	8	22	2	-	1
Closed Residential	430	207	203	20	-	-
Open Residential	804	478	296	28	2	-
Docks	113	64	39	8	1	1
Grand Totals	1,499	804	609	75	7	4

Discussion of results

Two important points emerge from a study of these results:-

(i) The small proportion of fly bombs - less than 20% - which started fires of any greater category than "small" even in the most heavily built-up areas; and

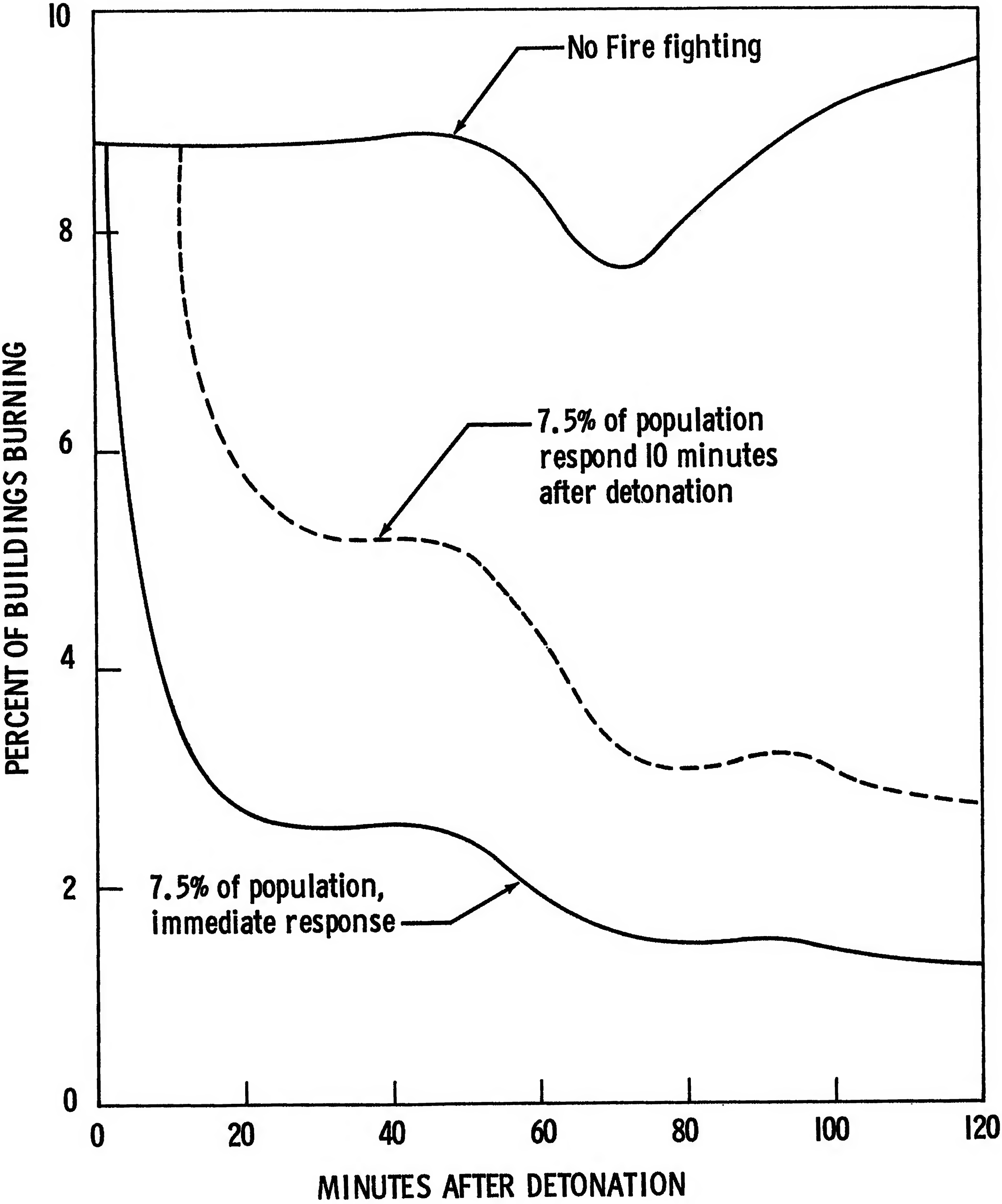
(ii) The large proportion which started no fires at all even in the most heavily built-up areas.

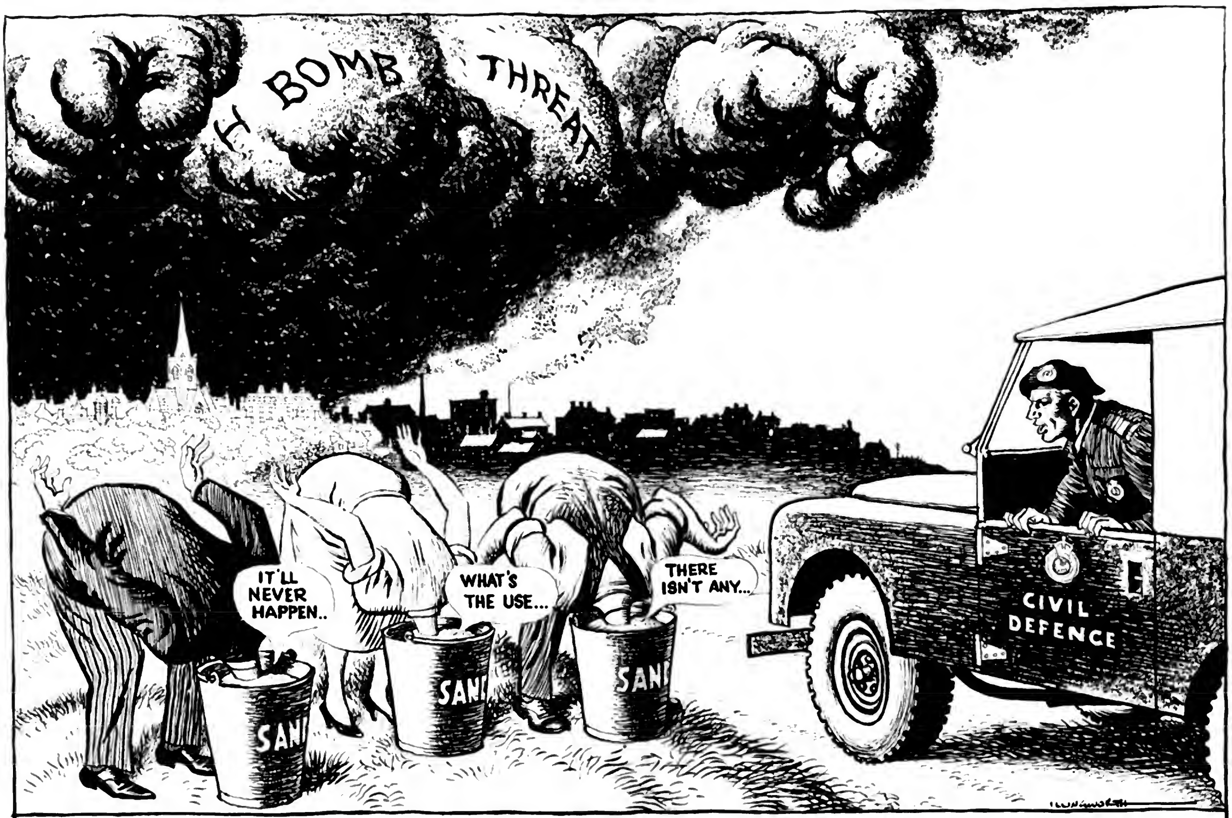
All these fly bombs fell in the summer months of 1944 which were unusually dry. In winter in this country in residential areas there are many open fires which may provide extra sources of ignition. The domestic occupancy is a low fire risk however, and as the proportion of such property in the important City and West End areas is small this should not introduce any serious error. Moreover, in winter, the high atmospheric humidity and the correspondingly high moisture content of timber would tend to retard or even prevent the growth of fire.

In order to determine how many fly bombs are equivalent to one nominal atomic bomb one method is to compare the areas over which a given category of house damage is produced by each. If we do this for a $\frac{3}{8}$th mile air burst as at Hiroshima, the result is that 1 atomic bomb does as much damage as about 1,200 fly bombs.

This in itself is not a serious fire situation and it is doubtful whether it could ever give rise to a fire storm. In Hamburg 2,500 fires were started per square mile by a bomb density (combined H.E. and I.B.) of 2oo tons per square mile, and for the area of destruction produced by an atomic bomb this would correspond to a total of about 10,000 fires.

Takata, A.N., **Mathematical Modeling of Fire Detenses, IITRI, March 1970, AD 705 388.**





Cartoon by Leslie Illingworth

IF YOU THINK IT'S HOPELESS, YOU'RE WRONG

Specially drawn for H.M. Government by Illingworth

FOUR STRAIGHTFORWARD SIMPLE FACTS ABOUT

Civil Defence Today

The basic minimum of information for every responsible man and woman

1 The H-Bomb: we hear too much of the horrors, not enough about our chances of survival. Some people will tell you that if this country were attacked with H-Bombs, every man jack of the population would be wiped out. ***That just isn't true: it isn't anything LIKE the truth.***

There would be terrible devastation, but for millions and millions of people, chances of survival would be very good. It depends very much on our Civil Defence. The more people we have in it, the better.

2 Civil Defence is well on with the job already. Some people think of Civil Defence equipment as a long-handled shovel, a rather odd tin hat, and so on.

Well, it's not like that at all. Civil Defence today is a modern, country-wide Service, which offers you training with first-class equipment—radio and radiation-testing instruments, fire-fighting apparatus and rescue gear, and the latest four-wheel-drive vehicles. There are thousands of qualified Instructors, three full-time Instructors' Schools, and a Staff College for advanced courses and studies.

The more you get to know about Civil Defence, the more impressed you become.

There is a Civil Defence organisation in every town in the Kingdom, and there are units in thousands of industrial firms. There are *half a million* people in the Civil Defence Services today. But half a million is not enough: not nearly.

3 Civil Defence is useful to you now, in peace. In Civil Defence today, you *learn*. That is the whole aim and object of joining.

You learn, first and foremost, how to live with your eyes open in the same world as the H-Bomb. You begin to learn what this new, nuclear-age world is really like. You acquire a fuller, deeper understanding of many important events that we are all involved in, whether we like it or not.

Besides this, there is a practical, everyday value in the things you learn. Take just one part of it—First Aid. In Great Britain in 1956 there were over *a quarter of a million* casualties from motor accidents, and probably at least another *million* casualties from accidents in the home. What you know—or don't know—about First Aid could make all the difference to somebody.

Do you know how to put out a fire? Do you know how to operate a radio transmitter? These are two more of the useful, interesting things that Civil Defence could teach you, now.

Do you remember the East Coast floods, the Lynmouth disaster, the Harrow rail smash? These are three of the emergencies where trained volunteers from Civil Defence were ready and able to help. They were needed.

4 Civil Defence wants more volunteers, NOW. It's no good saying "I'll be there on the day." That's too late. There wouldn't be time to train you and organise you.

It's no good leaving Civil Defence to other people. For everybody else, *The Other Fellow is YOU.*

You live in this world, you are part of the nuclear-age—there is no opting-out for anybody. Civil Defence *matters*—and matters to YOU.

Go along to your Council Offices today, and ask about Civil Defence. There's no commitment, no 'bull', no length-of-service engagements.

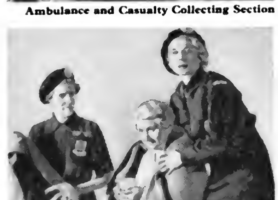
Your training takes only about *one hour a week*. The classes are free, and are near your own home. The knowledge you gain could be useful to you at any time, and would be VITAL to you if we were at War.

Civil Defence is sound common sense. It's high time you were in it.

Warden Section

Headquarters Section

Ambulance and Casualty Collecting Section



Welfare Section

The FOURTH Arm

Traditionally, we have three Services in this country: the Royal Navy, the Army, and the Royal Air Force. Now, we have a fourth service of the Crown—unarmed, volunteer, part-time—but not less vital than the others: Civil Defence. We have peacetime Civil Defence for just the same reasons that we have a peacetime Navy, Army and Air Force: it is an essential part of our ordinary peacetime national preparedness. *That is all there is to it.*

WHAT YOU CAN DO IN CIVIL DEFENCE

Five Sections: *which will you join?*

WARDEN. This is a job for a man or woman with a quick, cool head and the power of leadership—and something of a flair for getting on with people. The Warden takes control of the area in an emergency and directs the other services where they are required.

HEADQUARTERS. This is the nerve-centre, where the reports come in and the orders go out. If you are an office or scientific worker, a radio 'ham', motor-cyclist or driver—here is interesting, important work that you could train for now.

RESCUE. Members of Rescue Squads are highly skilled. Each man carries a pack containing saw, wrecking-bar, lashings, wire-cutters and First Aid kit—and he is trained in the use of all of them. Backing up the Rescue Squad is a special Rescue Vehicle, with scaffold-poles, cables, winches, stretchers and heavy rescue gear. A rescue man needs intelligence as well as strength.

The **AMBULANCE AND CASUALTY COLLECTING** Section want two sorts of people—casualty collectors, to give First Aid and see that the injured get back safely to the ambulances—and drivers to take the ambulances back to hospital. This is work for both men and women—and if you drive a car already, so much the better.

The **WELFARE** Section would be called on first to help in bringing care and comfort to some millions of evacuees. But that is only the beginning of their job. After an attack, there would be more millions of people, to be housed, clothed, fed and kept healthy. Our very survival could depend on what the Welfare Section did then. The Welfare Section needs dependable, intelligent, capable men and women; and it needs them now.

AND THE AUXILIARY FIRE SERVICE, which also has really worth-while, practical training to offer. The work is important; a nuclear explosion sends out an intense heat-wave, and fires would be numerous and quick to spread. The A.F.S. has special nuclear-war fire-fighting apparatus: you would do your training with it.

IN EVERY SECTION YOU GET FIRST AID TRAINING

Rescue Section

Auxiliary Fire Service

Civil Defence Recruiting Drives are going on now, all over the country. Their object is to tell you all about Civil Defence — what it can do, what it IS doing and what there is in it for you.

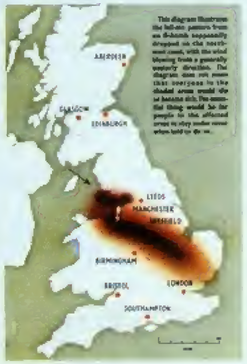
CIVIL DEFENCE is common sense

Go to your Council Offices and ask, today. They will be glad to see you.

ISSUED FOR H.M. GOVERNMENT BY THE CENTRAL OFFICE OF INFORMATION

THE Hydrogen Bomb

WHAT THE HYDROGEN BOMB DOES



This diagram illustrates the fall-out pattern from an H-bomb supposedly dropped on the north-west coast, with the wind blowing from a generally westerly direction. The diagram does not mean that everyone in the shaded areas would die of harmful fall. The essential thing would be for people in the affected areas to stay under cover when told to do so.

The hydrogen bomb's power is reckoned in millions of tons of high explosive; its searing fireball, white and blinding, is as hot as the sun's interior. It can gouge a crater in the earth a mile wide and up to 200 feet deep; and its dust can cause death or sickness hundreds of miles away if proper precautions are not taken. The menace is threefold, for the hydrogen bomb strikes with heat, blast and deadly radiation.

HEAT from the fireball, a mile-and-a-half across, instantly vaporizes anything it touches before it soars into the upper skies. Fiercest during the first ten seconds, its rays can burn exposed skin or set fire to houses as far away as 10 to 15 miles. They can still be felt at 50 miles.

BLAST surges outwards at the speed of sound, accompanied by a hurricane wind. It enters doors and windows, causing buildings to "explode". It tilts or overthrows walls in its path. An overhead burst crushes roofs through their supporting walls. The worst danger is that people might be struck by flying wreckage, or hurled to the ground or against walls or other objects. Light damage from an air burst could be found as far as 20 to 25 miles from the centre of the explosion, and windows would be broken even farther away.

RADIATION The rising fireball sucks up and contaminates debris and dust and this is carried downwind to drift slowly back to earth as "fall-out". There it continues to give out dangerous radiation. Radiation is particularly dangerous because it cannot be felt or smelled, tasted, heard or seen. It can be detected and measured only with sensitive instruments. Even if you kept all the fall-out dust off you, you might still be injured, if you stayed in the open, by radiation from fall-out many yards away.

The photograph shows Britain's nuclear test explosion at Christmas Island on 15 May, 1957. The swirling mushroom, now well developed, has pierced the local natural cloud.

What YOU could do

Simple precautions which you and your family could take against heat, blast and radiation could save your lives. Heat and blast are familiar from the last war. Radiation is new, and only a thick shield of metal, masonry, earth or other heavy matter will protect you against it. Used to the best advantage, an ordinary house with 9-inch brick walls should reduce the danger from radiation to one-twentieth. Here are some things you could do if war looked likely:

Site a refuge in basement or cellar, or in the ground floor room with the fewest outside walls. Thicken the walls with sandbags or even heavy furniture. Block the windows. Equip the refuge with essentials, including chairs and couches, books and a battery-run radio. Store an ample supply of food and water.

Alternatively, dig an outside trench, cover it with a strong roof, put two or three feet of earth on top. Equip it like an indoor shelter if possible. A trench may be less comfortable than an indoor shelter but there is no risk from collapsing upper floors and walls. Whether in trench or indoors, obey radio instructions. Because of fall-out you might have to remain two or more days under cover.

It is the contents of a house which catch fire, and not the bricks and mortar. So keep out as much of the heat flash as possible.

Remove curtains, furnishings and anything inflammable from windows and doorways.

Whitewash the window panes. This will block most of the heat, which will be largely over before the blast catches up to shatter the glass.

WHAT YOU CAN DO NOW Join the Civil Defence Corps or the Auxiliary Fire Service. They will teach you how to help yourself and others if war should come.

APPLY TO YOUR LOCAL COUNCIL OFFICES

What CIVIL DEFENCE can do!

There is no absolute safeguard against an H-bomb attack. Nothing could stop wide-spread casualties and devastation. But life would go on. It would be disrupted and distorted, with many familiar services lacking or severely cut, but that would not mean an end to everything – not by any means. Millions of people would survive to carry on. How many, and how far they succeeded, would largely depend on their knowledge of what to do as a nation and as individuals before and after the bombs struck.

Civil Defence, the part-time, volunteer Fourth Arm of our defence services, is being trained to act in an H-bomb emergency. Established throughout Britain, its members would spring to action in the stricken areas. Civil Defence is organised and trained to allay panic, aid the injured, trapped and homeless, and help to establish order and maintain the nation's life.

The Civil Defence Corps and its allied services each have specialised jobs as well as general duties.

THE HEADQUARTERS SECTION

Controls operations, provides scientific intelligence, establishes "fall-out" danger zones, arranges communications.

THE WARDEN SECTION

Provides the men, cool-headed and resourceful, who are the link between civil defence and the public and direct the other services where they are most needed.

THE RESCUE SECTION

Using specialist equipment, frees people trapped under wreckage or in shattered buildings. Duties may range from demolition work to providing first aid.

THE WELFARE SECTION

Houses, feeds and cares for the homeless and hungry.

THE AMBULANCE & CASUALTY COLLECTING SECTION

gives first aid, gets the casualties to the ambulances, and takes them to hospital.

The Fire, Police, Nursing and other allied Services, with their normal duties doubled by an emergency, link with the Civil Defence Corps in carrying out the plan for survival.

PREPARED FOR THE HOME OFFICE BY THE CENTRAL OFFICE OF INFORMATION

PRINTED FOR H.M. STATIONERY OFFICE BY J. HEWITT & SON LTD., NOTTINGHAM

HOME OFFICE

CIVIL DEFENCE

Manual of Basic Training

VOLUME II

ATOMIC WARFARE

PAMPHLET No. 6

(Based on survival in Hiroshima

and Nagasaki after 20 kt bursts)

LONDON: HIS MAJESTY'S STATIONERY OFFICE
1950

TWO SHILLINGS NET

FOREWORD BY THE PRIME MINISTER

The object of this pamphlet is to provide all members of the Civil Defence Corps and other Services associated with Civil Defence with a short manual of practical information about the atomic bomb and its effects. It is, of course, our earnest hope that we shall never have to experience the horrors of an atomic attack. The tremendous force of atomic power should be used for industrial and humanitarian purposes and not for mass destruction. Ever since the Washington Declaration, which I signed with the President of the United States and the Prime Minister of Canada in November 1945, the United Kingdom has pressed for international agreement to ensure that atomic energy should be used only for peaceful purposes. But any such agreement would be illusory without the most rigorous system of international control. Although nearly two years ago nine out of the eleven members of the United Nations Atomic Energy Commission agreed on what they considered to be a really effective plan for the control of atomic energy and although this plan was subsequently approved by the overwhelming majority of the General Assembly of the United Nations, the Soviet Union has so far refused to accept it, and has instead put forward counter-proposals which were rejected in the Commission by a nine to two vote on the ground that they did not provide an adequate basis for effective international control. We shall not, however, abandon our hope that an effective system of international control may ultimately be adopted by the United Nations, and we for our part will certainly do all in our power to make such an agreement possible. In the meantime we must proceed with our Civil Defence preparations on the basis that, in the event of war, we might be subjected to atomic attack and with the object of minimising the casualties which must inevitably accompany such an attack.

June, 1950.

C R Attlee

CONTENTS

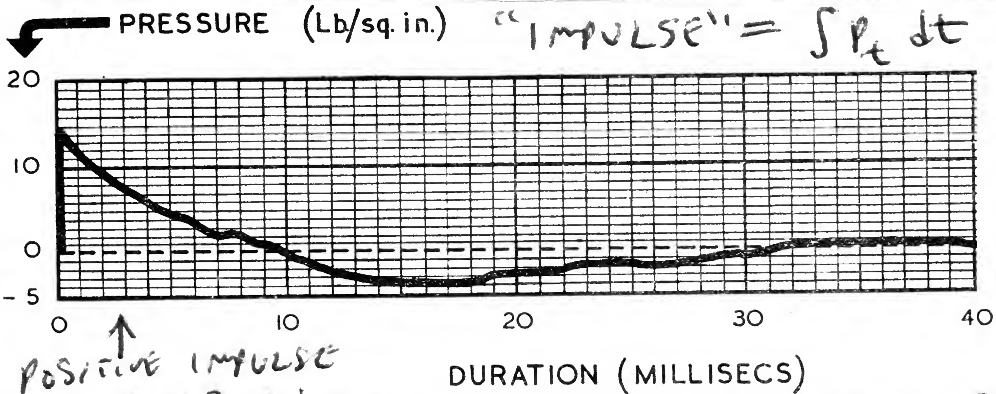
NOTE

The pagination of this pamphlet is not continuous as it may be necessary to introduce new pages at a later date.

Photo No. 18. NAGASAKI. Typical small earth-covered back yard shelter with crude wooden frame, less than 100 yds. from the centre of damage, which is to the right. There was a large number of such shelters, but whereas nearly all those as close as this one had their roofs forced in, only half were damaged at 300 yds., and practically none at half a mile from the centre of damage.

Debunking impulse blast criteria:

"IMPULSE" = $\int P_t \, dt$



POSITIVE IMPULSE = 0.12 PSI-SEC

FIG. 2. — PAGE 13.

Figure 2 shows a typical pressure-time curve from a medium sized high explosive bomb at a distance at which fairly severe structural damage would be caused. **- page 11**

If the impulse criterion were applied to the atomic bomb it would be expected to demolish 9-inch brick walls to a distance of over 10 miles. However, at this distance from the atomic bomb the peak pressure is only about 0.1 lb./sq. in. which is very much less than the static strength of the wall, and consequently, however long this pressure is applied, it cannot hurt the wall. It will thus be seen that the impulse criterion breaks down for the atomic bomb. The position is that the blast impulse is only the criterion of damage so long as the maximum blast pressure is substantially greater than the static strength of the target, and this is not the case at the limits of damage to normal structures with an atomic bomb. With the atomic bomb, therefore, blast pressure rather than impulse tends to be the criterion of damage. If the effective blast pressure exceeds the static strength of the structure failure must be expected, whereas if it is less no failure can occur however long the duration of the blast. **- page 12** **(debunks American propaganda!)**

Photo No. 7. HIROSHIMA. Reinforced concrete building about 300 yds. from the centre of damage, which is to the left of the photograph. There was no serious structural damage, although a roof panel was depressed and some internal party walls were deflected. Designed for earthquake resistance, this building has a composite reinforced concrete and steel frame.

SIMPLE WALL SURVIVING CLOSE TO GROUND ZERO.

Photos Nos. 1 and 2. HIROSHIMA. General views looking across the centre of damage, the approximate position of which is marked with an arrow. It will be seen that some of the framed buildings quite near the centre remained standing. The tall building in Photo No. 1 is the same as that seen in Photo No. 7. The foreground illustrates the remnants of Japanese dwellings, razed to the ground. =THE OBSOLETE WOODEN HOUSES BURNED DOWN.

Protection against blast would not present an insoluble problem. Japanese air raid shelters, even of poor construction, stood up well and underground shelters were a complete protection. Shelters could be constructed to resist both blast and gamma rays.

28. **Effects on Material** PAGE 39:

From air burst bombs the blast wave is from above downwards and strikes roofs first, and near the centre of the damaged area buildings are collapsed or, with specially strong buildings, roofs are crushed in or dished even where the walls remain standing. Further away, where the blast wave is becoming more horizontal, buildings are pushed over or distorted.

The type of building and the distance from ground zero are the factors influencing reaction to blast. Unframed buildings like ordinary dwelling houses suffer more severe damage than framed buildings, whether of reinforced concrete or steel, and buildings of earthquake-resisting construction remain practically undamaged at 2,000 feet from ground zero. Bridges, which are built to withstand vertical pressure, stand up to the blast much better than ordinary houses, which are not so constructed, though reflection from roads, rivers, etc., may cause displacement on the underside and is a point to be carefully watched.

The British Mission estimated that from a high air burst bomb such as was used in Japan, an ordinary British city with 15 houses and 45 persons to the acre would suffer damage to dwelling houses to a distance of 2 to 2½ miles from ground zero on the following scale:—

Nature of Damage	*Average Radius from Ground Zero and Number of Houses Involved*
Demolished or requiring demolition	1 mile 30,000 houses
Uninhabitable and requiring major repairs	1–1½ miles 35,000 houses

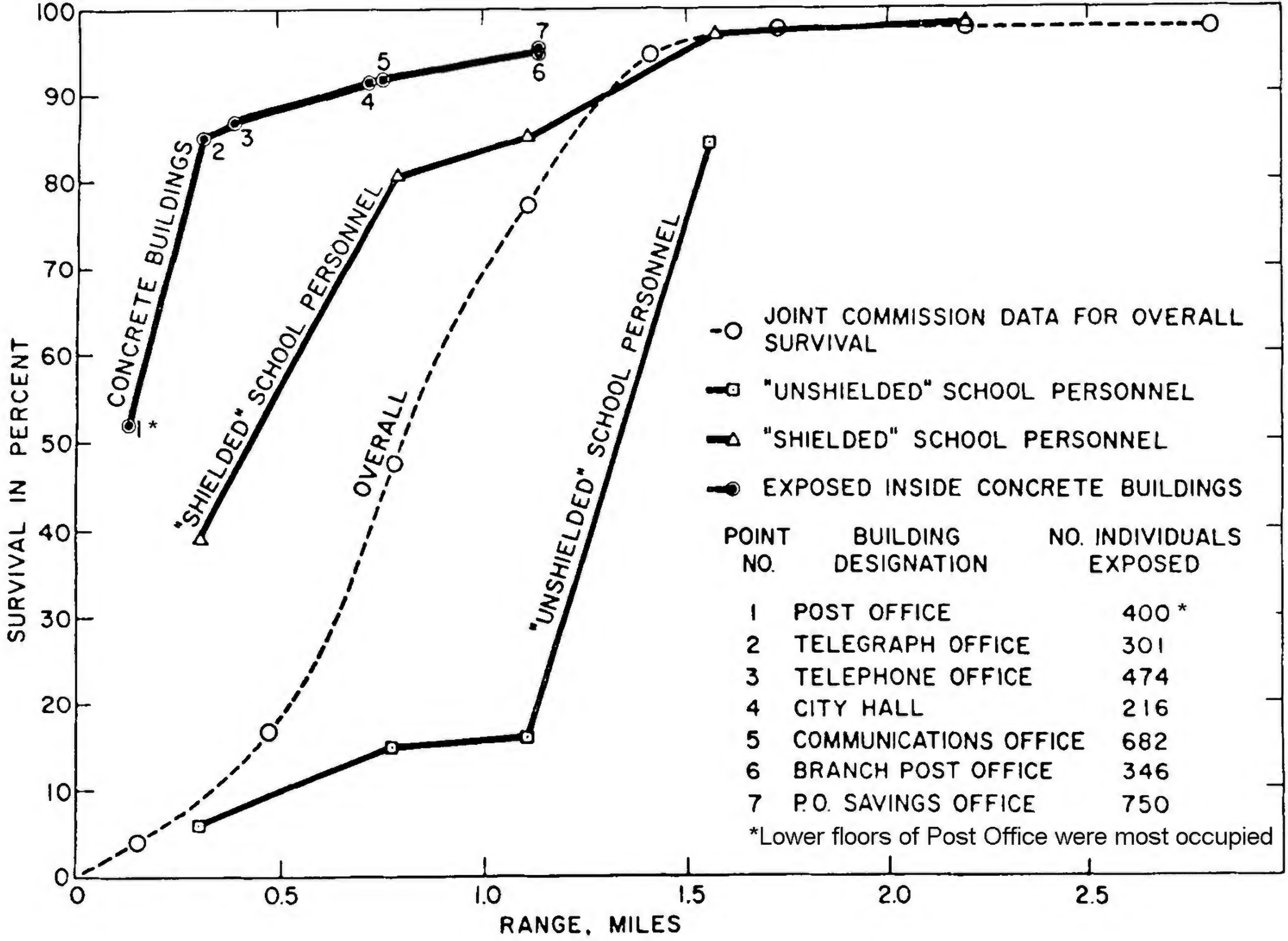
5. **Estimates of Casualties in a British City** — PAGE 13:

If the people in our cities were caught, as were the Japanese, without warning, before any evacuation had taken place, and with no suitable shelters, the casualties caused by a high air burst bomb would be formidable. The British Mission to Japan estimated that *under these circumstances* as many as 50,000 people might lose their lives in a typical British city with a population density of 45 persons to the acre. Much can be done, however, to mitigate the effects of the bomb and to save life, and it is certain that with adequate advance preparations, including the provision of suitable shelters and with good Civil Defence services, the lives lost could be reduced to a fraction of the number estimated by the British Mission.

The figures set out in the preceding paragraph are those given as an estimate by the British Mission from the experience of the high air burst bombs used in Japan and under similar conditions would apply to persons in a British city. *It must be stressed however that they apply to persons caught in the open with no warning or suitable shelter,* and that even ordinary houses will give some degree of protection by lessening the intensity of the rays that penetrate them. — PAGE 9.

Hiroshima at
2 days after burst

Hiroshima in November 1945: note boarded windows
repaired power lines, and cleared roads.



Percentage of survivors as a function of range from Ground Zero (Hiroshima). (Ref. Joint Commission Report, Vol. VI, Document NP-3041.)

SURVIVAL IN WOODEN AND CONCRETE BUILDINGS, HIROSHIMA

TABLE 7.3

Casualties among the Groups Exposed to the Atomic Bomb inside Wooden Houses, Hiroshima

Name of Building	Structure	Distance and Direction from Hypocenter (km)	Number Exposed	Mortality Rate (%)
Lodging for an itinerant theatrical troupe	Two-story	0.7 E	17	100.0
Second Hiroshima Army Hospital	Single-story	1.0 N	402	75.3

Source: Science Council of Japan, *Genshibakudan Saigai Chōsa Hōkokusho* [SRIABC] (Tokyo: Nihon Gakujutsu Shinkōkai, 1951), p. 25.

TABLE 7.4

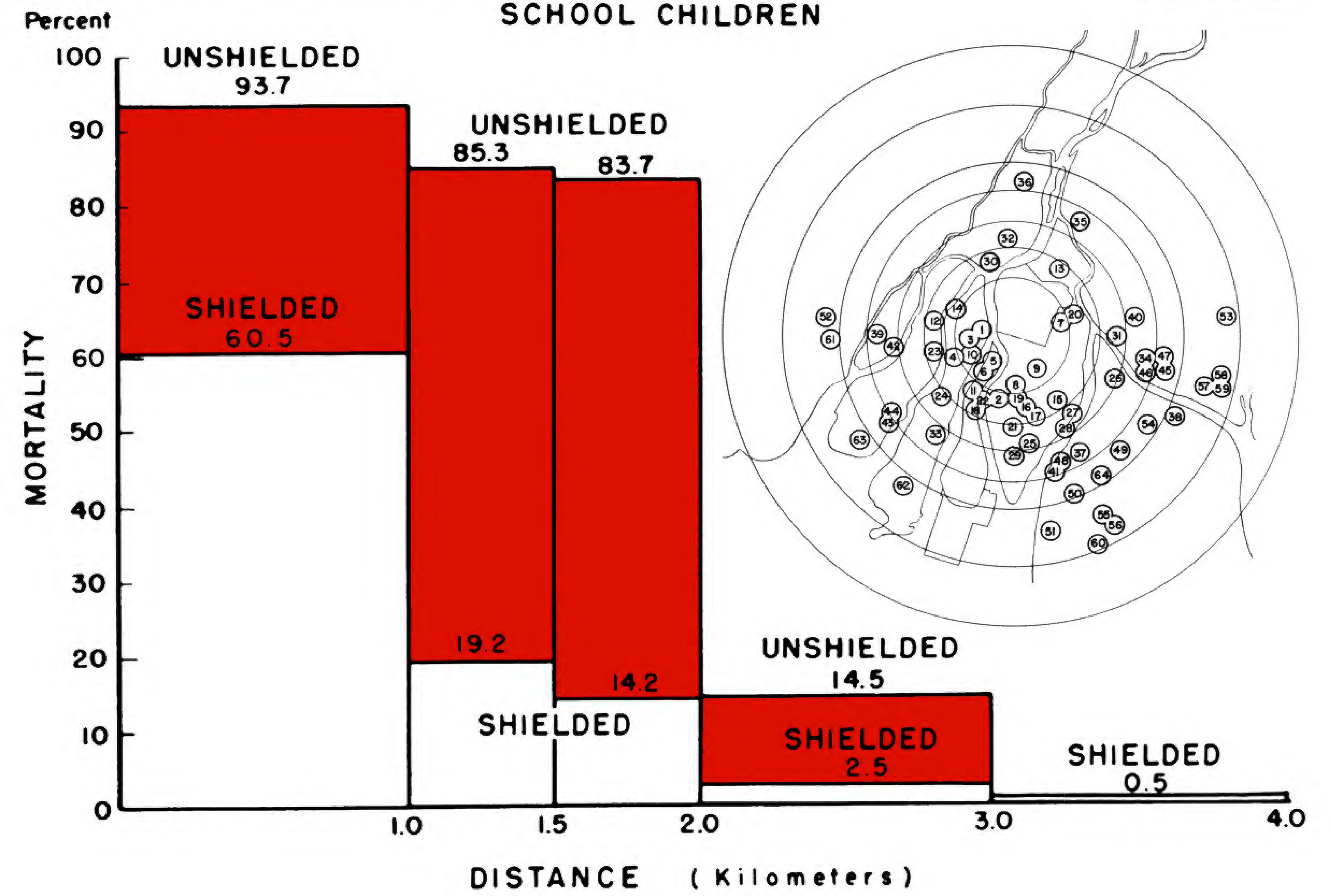
Casualties among the Groups Exposed to the Atomic Bomb inside Concrete Buildings, Hiroshima

Name of Building	Structure	Direction and Distance from Hypocenter (km)	Number Exposed	Mortality Rate (%)
The Bank of Japan, Hiroshima Branch	three-story	0.4 SE	75	57.3
Broadcasting Station	two-story	1.0 E	31	6.5
Communication Bureau	four-story	1.4 N	245	6.1
Japan Red Cross Hospital, Hiroshima	three-story	2.0 S	480	0.4

• While the total number of exposed is known, it has not been possible to determine how many died instantly or soon after the explosion.
Source: Science Council of Japan, *Genshibakudan Saigai Chōsa Hōkokusho* [SRIABC] (Tokyo: Nihon Gakujutsu Shinkōkai, 1951), p. 26.

Above: extract from "Hiroshima and Nagasaki: The Physical, Social and Medical Effects", 1981

THERMAL FLASH SHIELDING — HIROSHIMA
SCHOOL CHILDREN



In Hiroshima, only 0.9% (17 burns) of 1,881 burns were due to ignited clothing, and only 0.7% (15 burns) were due to burns by firestorm flames!

TABLE 8.3A

Number of Persons with Burns from Different Causes (Tokyo Imperial University's First Survey, October–November 1945)

Distance from Hypocenter (km)	Secondary Burns† From Clothes on Fire	Secondary Burns† By Flame	Total Burns
0.6–1.0	3 (3.3)		89
1.1–1.5		1 (1.1)	327
1.6–2.0	4 (0.5)	4 (1.2)	717
2.1–2.5		6 (0.8)	558
2.6–3.0	5 (0.8)	3 (0.5)	140
3.1–3.5	4 (2.8)	1 (0.7)	41
3.6–4.0	1 (2.4)		4
Total	17 (0.9)	15 (0.7)	1,881

* Primary burns are burns by thermal rays from the A-bomb.
† Secondary burns are burns by fire other than thermal rays.
‡ Figures in parentheses are percentages of incidence.
Source: T. Kajitani and S. Hatano, "Medical survey on acute effects of atomic bomb in Hiroshima," in CRIABC vol. I, p. 522.

Note: there were 5 burns cases within 0.6 km, all primary

TABLE 8.3B

Region of Burns

	Head		Face		Neck		Total	
	Outdoors	Indoors	Outdoors	Indoors	Outdoors	Indoors	Outdoors	Indoors
Number of persons	179 (11.7)*	44 (12.3)	1,030 (67.4)	127 (35.7)	643 (42.1)	78 (21.9)	1,526	355
Total	223 (11.8)		1,157 (61.5)		721 (38.3)		1,881	

* Figures in parentheses are percentages of incidence.
Source: T. Kajitani and S. Hatano, "Medical survey on acute effects of atomic bomb in Hiroshima," in CRIABC vol. I, p. 522.

Above: extract from "Hiroshima and Nagasaki: The Physical, Social and Medical Effects", 1981 by the Japanese Committee for the Compilation of Materials on Damage Caused by Atomic Bombs

HIROSHIMA: Bankers Club, 250 m from GZ, view looking out from GZ.
Photograph date: 27 November 1945.

HIROSHIMA: Nippon Bank, 450 m from GZ, view from GZ. Photograph date: 27 November 1945.

HIROSHIMA: Telephone Exchange Building, 550 m from GZ, view from GZ
Photograph date: 27 November 1945

HIROSHIMA: Radio Broadcasting Studio, 900 m from GZ, view from GZ
Photograph date: 27 November 1945.

HIROSHIMA: City Hall, 1200 m from GZ, view from direction of GZ.
Photograph date: 27 November 1945.

HIROSHIMA: Red Cross Hospital, 1600 m (1 mile) from GZ, view looking from the direction of GZ
Photograph date: 27 November 1945


HIROSHIMA: 26 October 1945

HIROSHIMA: 27 November 1945

SINGLE NON-NUCLEAR INCENDIARY AIR RAID: TOKYO, 10 MARCH 1945

AIR MINISTRY
AP 3349

RESTRICTED
The information given in this document is not to be communicated, either directly or indirectly, to the Press or to any person not authorized to receive it.

WO
CODE No.
9466

26/GS Trg Publications/2329

PRECAUTIONS AGAINST NUCLEAR ATTACK

1957

(Superseding Precautions Against Atomic Attack, 1952 (WO Code No. 8769))

Promulgated by Command of the Army Council,

E. W. Playfair

Promulgated by Command of the Air Council,

J. H. Barnes

Telegraph pole burnt on the side facing the flash. Note where foliage has acted as a shield

Shelter 100 yards from the centre of damage—Nagasaki

Protection against fall-out

101. Except in the immediate vicinity of a nuclear explosion a reasonably accurate prediction of the area of fall-out can be made in time for a warning to be issued to units in the areas in which it is likely to fall. Given a reasonable warning it may be possible to evacuate the area before the fall-out arrives. In any case simple precautionary measures can greatly reduce the hazard to life.

102. Exposure to the radio-active radiations from fall-out can be reduced by taking shelter and by using simple decontamination procedures until such time as persons can leave the area. In areas where radio-active contamination is heavy it may be necessary to remain under cover for as long as 48 hours before the radiations will have fallen, by natural decay, to levels at which it will be safe for persons to move about, either to leave the area, or, in the case of rescue teams from other areas, to enter it.

103. The estimated degree of protection against the residual radiation to be obtained from buildings, trenches, etc, in a fall-out area is shown at Table 7:—

TABLE 7. **Estimated degree of protection against the residual radiation to be obtained from various buildings, trenches, etc, in a fall-out area**

Type of building or shelter	INSIDE dose expressed as a fraction of the OUTSIDE dose	
Slit trench with light board or corrugated iron overhead	$\frac{1}{2}$	
Slit trench with 1 ft of earth overhead	$\frac{1}{100}$	
Slit trench with 2 ft to 3 ft of earth overhead	$\frac{1}{200}$ to $\frac{1}{300}$	
Nissen hut	$\frac{1}{2}$	
One storey brick house	$\frac{1}{10}$ to $\frac{1}{20}$	dependent upon wall thickness and shielding afforded by neighbouring houses
Two storey brick house	$\frac{1}{10}$ to $\frac{1}{50}$	
Three storey brick house	$\frac{1}{15}$ to $\frac{1}{100}$	
Average two storey house in a built up area	$\frac{1}{40}$	
Basements	$\frac{1}{200}$ to $\frac{1}{300}$	dependent upon shielding afforded by neighbouring houses

COPY No. 15
14 PAGES

[redacted]

AWRE - T1/53

Wd 22/10/84 . SCO 468 refers

NATIONAL ARCHIVES
ES5/1

MINISTRY OF SUPPLY

ATOMIC WEAPONS RESEARCH ESTABLISHMENT

REPORT No. T 1/53

(HURRICANE)

B. 0134

A.W.R.E.
Aldermaston Berks.

[redacted]

May, 1953

3.2 Blast Damage

Outdoor peak overpressure was 51 psi at 500 yds,
25 psi at 665 yds and 10 psi at 1,000 yds
3 psi extended to 2,000 yds

3.2.1 Anderson Shelters

Standard Anderson Shelters, with sandbag covering and blast wall construction were locat:d at 460, 510, 600, 920 and 1,130 yards from ground zero. Mean blast pressures, in pounds/sq. inch, recorded inside the shelters are shown in the following table.

Distance (yds.)	Presentation		
	Front	Side	Rear
460	NR	NR	NR
510	38	27	40
600	28	21	28
920	16	7	14
1130	8.5	4	5.5

Front presentation implies blast wall facing towards event.
Rear " " " " " away from event.
Side " " shelter side on to event.

Shelters at 460, 510 and 600 yards suffered damage including demolition of blast walls, removal of sandbag covering and some displacement of the corrugated iron.

At 920 and 1,130 yards the shelters suffered relatively little damage.

Civil defence authorities consider that there might have been some 50% survival from blast damage of personnel in shelters at 460 yards and some 90 per cent at 600 yards, fatal casualties being mainly due to secondary blast effects (e.g. debris) and not to direct effects on the person of the blast pressure itself. The front presentation appears the most hazardous, due to the collapse of the blast wall into the shelter. At such distances, however, the survival from the effects of gamma flash would have been virtually nil. (MORE EARTH COVER IS NEEDED FOR RADIATION.)

At 920 and 1,130 yards there would have been no casualties from blast, and incidentally, little risk from the effect of gamma flash.

UK NATIONAL ARCHIVES: ES 5/2

ANDERSON SHELTER TESTS AGAINST 25 KT NUCLEAR NEAR SURFACE BURST (2.7 METRES DEPTH IN SHIP)

AWRE-T1/54, 27 Aug. 1954

SECRET—GUARD

ATOMIC WEAPONS RESEARCH ESTABLISHMENT

(formerly of Ministry of Supply)

SCIENTIFIC DATA OBTAINED AT OPERATION HURRICANE

(Monte Bello Islands, Australia—October, 1952)

$$p = \frac{130 \times 10^9}{R^3} + \frac{7 \cdot 7 \times 10^6}{R^2} + \frac{13 \cdot 5 \times 10^3}{R}$$

p is the maximum excess pressure in p.s.i. and R is the distance in feet

Fig. 12.1, Andersons at 1380 ft range from bomb ship shown in the photo, moored 400 yards off shore.

Left: Fig. 12.3, Andersons at 1800 ft after burst. Right: Fig. 12.4, Andersons protected by blast walls at 2760 ft.

12.1. *Blast Damage to Anderson Shelters*

At 1,380 feet, Fig. 12.1, parts of the main structure of the shelters facing towards and sideways to the explosion were blown in but the main structure of the one facing away from the explosion was intact, and would have given full protection. At 1,530 feet, Fig. 12.2, the front sheets of the shelter facing the explosion were blown into the shelter but otherwise the main structures were more or less undamaged, as were those at 1,800 feet, Fig. 12.3.

At 2,760 feet, Fig. 12.4, some of the sandbags covering the shelters were displaced and the blast walls were distorted whilst at 3,390 feet, Fig. 12.5, the effect was quite small. At these distances, the shelters were not in direct view of the explosion owing to intervening sandhills.

13. The Penetration of the Gamma Flash

13.1. *Experiments on the Protection from the Gamma Flash afforded by Slit Trenches*

13.1.1. The experiments described in this section show that slit trenches provide a considerable measure of protection from the gamma flash. From the point of view of Service and Civil Defence authorities this is one of the most important results of the trial.

13.1.2. Rectangular slit trenches 6 ft. by 2 ft. in plan and 6 ft. deep were placed at 733, 943 and 1,300 yards from the bomb and circular fox holes 2 ft. in radius and 6 ft. deep were placed at 943 and 1,300 yards.

The doses received from the flash were measured with film badges and quartz-fibre dosimeters in order to determine the variation of protection with distance, with depth and with orientation of the trench and the relative protection afforded by open and covered trenches.

In general, the slit trenches were placed broadside-on to the target vessel but at 1,300 yards one trench was placed end-on. Two trenches, one at 733 and one at 943 yards were covered with the equivalent of 11 inches of sand.

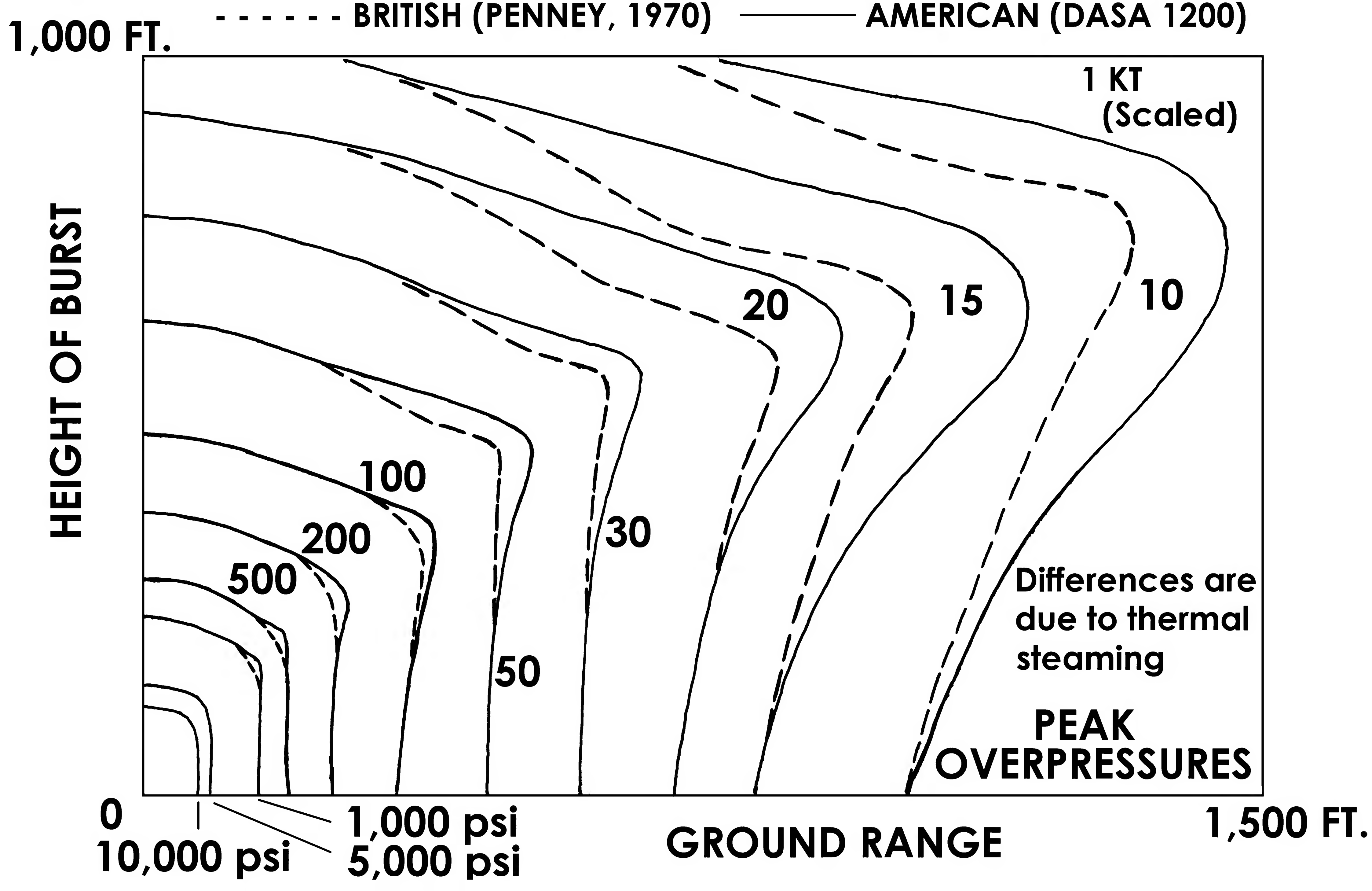
Table 13.1

Variation of Gamma Flash Dose on Vertical Axis of Trench

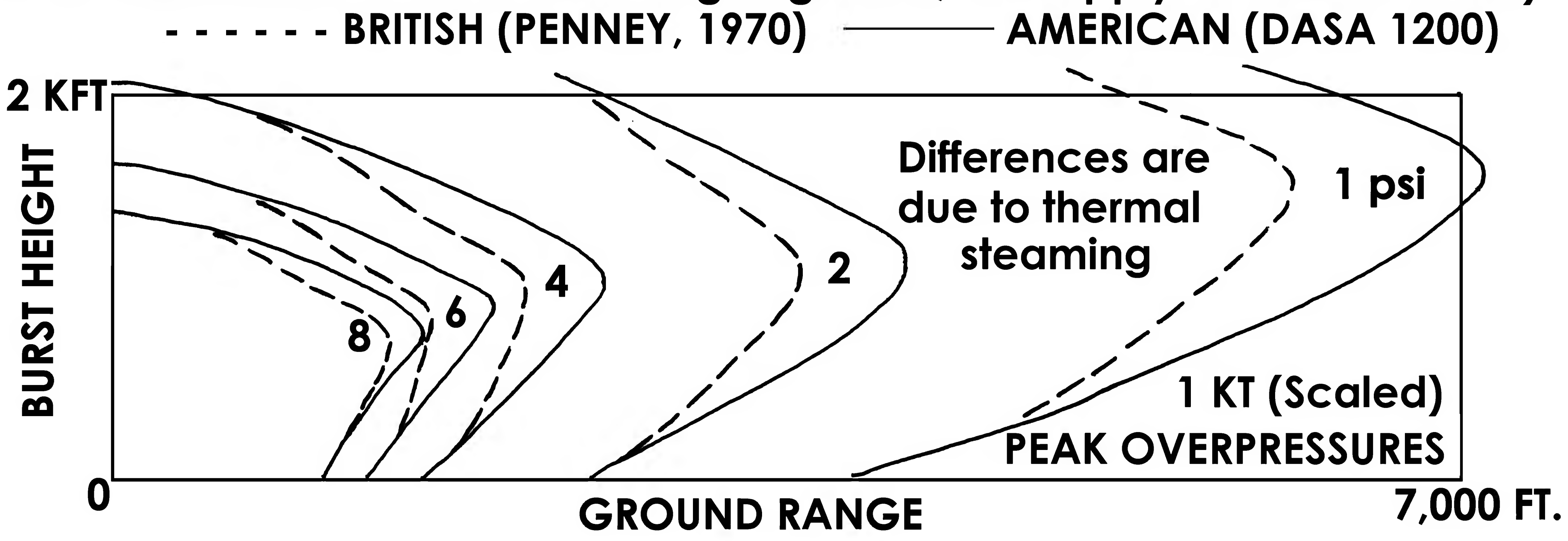
Type of trench	Rectangular broadside-on open			Rectangular end-on open	Circular open		Rectangular broadside-on covered	
Distance (yards) ...	1,300	943	733	1,300	1,300	943	943	733
Surface dose (Roentgens)	300	3,000	14,000	300	300	3,000	3,000	14,000
Depth below ground level (inches)								
6 ...	150	1,000	—	230	214	1,200	(75)	—
12 ...	75	430	—	150	120	545	47·6	—
24 ...	33·3	150	584	60	54·5	188	25	(140)
36 ...	23	70	216	31·6	30	86	13	(56)
48 ...	(20)	43	100	20	17·7	48·5	7·7	(31)
60 ...	—	(37·5)	61	13·6	10·7	(33·3)	5	(23)
72 ...	—	—	(46·7)	(8·6)	7	—	(3·5)	—

Entries in brackets are extrapolations or estimates.

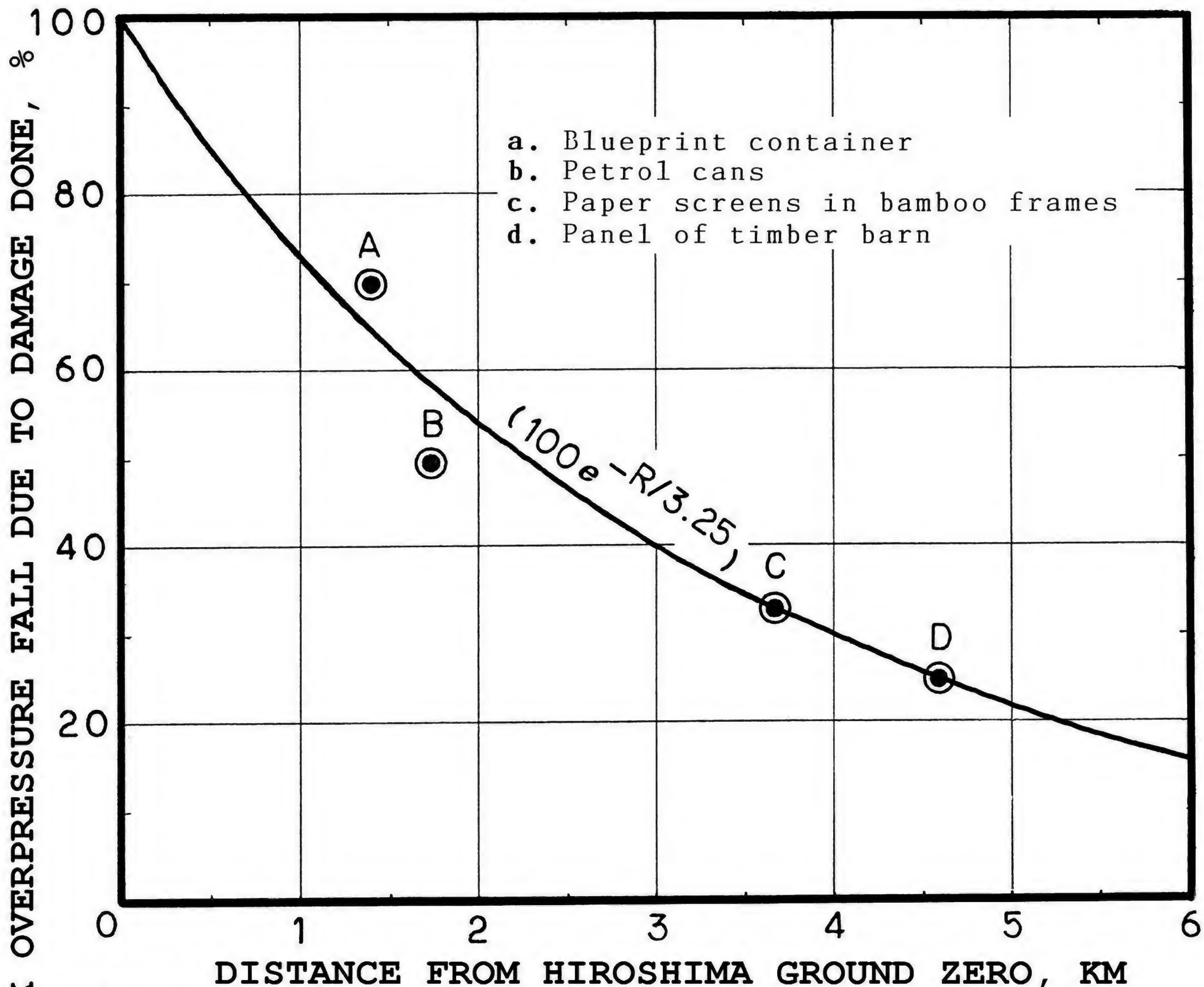
COMPARISON OF BRITISH NUCLEAR HEIGHT OF BURST CURVES WITH AMERICAN
(British data avoid thermal steaming of ground, thus apply to modern cities)



COMPARISON OF BRITISH NUCLEAR HEIGHT OF BURST CURVES WITH AMERICAN
(British data avoid thermal steaming of ground, thus apply to modern cities)



Lord Penney (1970) explains that the thermal energy deposited on desert surface before the blast arrives adds energy to the near-surface blast (hot air steams upward rapidly by convection; this is for 1-15 kt low yield air bursts that do NOT popcorn the desert sand, so there is NO precursor dust storm, just heated air). Where ground range >> burst height, in a modern city the first high rise building absorbs the majority of the thermal flash energy, preventing this effect. (Penney proves that modern buildings in Hiroshima and Nagasaki actually ABSORBED blast energy, causing a further attenuation factor, not included above.)



Data from Dr W. G. Penney, et al., 'The Nuclear Explosive Yields at Hiroshima and Nagasaki', Phil. Trans. Roy. Soc., v266 (1970), pp. 357-424.

HOME OFFICE
SCOTTISH HOME DEPARTMENT

MANUAL OF CIVIL DEFENCE

Volume I

PAMPHLET No. 2

RADIOACTIVE FALL-OUT

PROVISIONAL SCHEME OF PUBLIC CONTROL

LONDON
HER MAJESTY'S STATIONERY OFFICE
1956

Radioactive Fall-out—Summary of Provisional Control Zones

Zone	Definition of Zone Boundaries	Range of Cumulative Doses in open at 48 hours	Summary of permissible and recommended action	Range of Cumulative Doses assuming observance of control rules
W	Outer: Limit of area placed under "Black Warning" (*see* Footnote). Inner: 0·3 r.p.h. at 48 hrs.	Up to 80r	Complete release from refuge as soon as dose-rate fell to 0·3 r.p.h. or, if the rate had not reached that figure, when fall-out was complete.	At 48 hrs. Below 2r
X	Outer: 0·3 r.p.h. at 48 hrs. Inner: 3 r.p.h. at 48 hrs.	80–800r	Qualified release from refuge after 48 hrs.—indoor workers to follow normal occupations, but not to exceed 4 hrs. per day in the open. Outdoor workers to work half shifts for next five days. At the end of this period the zone would be normal, except that all would be advised to be out of doors as little as possible and not in any case to exceed 8 hrs. per day in the open for the next three months.	At 48 hrs. 2-20r At 7 days 6-60r At 5 wks. 12-120r At 3 mths. 14-145r
Y	Outer: 3 r.p.h. at 48 hrs. Inner: 10 r.p.h. at 48 hrs.	800-2,800r	Release from refuge under stringent control after 48 hrs. For the next 12 days people should not leave their refuge for longer than necessary. Time in the open should not exceed 2 hrs. per day and time under cover, but not in refuge, a further 8 hrs. On this basis essential indoor workers should be able to get to their places of work, but outdoor work would remain suspended; a relaxation would be possible after the first fortnight and further easement in another three weeks. For the rest of the first year, however, people in this zone should not exceed 8 hrs. a day in the open.	At 48 hrs. 20-70r At 14 days 50-170r At 5 wks. 70-240r At 3 mths. 95-330r
Z	10 r.p.h. at 48 hrs.	Above 2,800r	All movement outside refuge accommodation in this zone would be dangerous. People should remain in refuge until instructions for clearance were given—they should then leave the zone by the quickest available route if they had means of transport or wait in their refuge to be collected if they had not. The clearance operation might start after 48 hrs. and removal from the zone would be for at least 3 months.	At 48 hrs.—Above 70r

The initial Zone W boundary would be defined by the boundaries of a series of warning districts on the flanks of the fall-out. After 48 hrs. Zone W would for public control purposes have disappeared: its outer boundary would have moved during the period to coincide with the outer boundary of Zone X.

The question of defining an area extending in some places beyond Zone W in which there might be an agricultural hazard is being studied.

TECHNICAL ANALYSIS REPORT - AFSWP NO. 507

RADIOACTIVE FALL-OUT HAZARDS FROM SURFACE BURSTS OF VERY HIGH YIELD NUCLEAR WEAPONS

by

D. C. Borg
L. D. Gates
T. A. Gibson, Jr.
R. W. Paine, Jr.

MAY 1954

HEADQUARTERS, ARMED FORCES SPECIAL WEAPONS PROJECT
WASHINGTON 13, D. C.

e. Passive defense measures, intelligently applied, can drastically reduce the lethally hazardous areas. A course of action involving the seeking of optimum shelter, followed by evacuation of the contaminated area after a week or ten days, appears to offer the best chance of survival. At the distant downwind areas, as much as 5 to 10 hours after detonation time may be available to take shelter before fall-out commences.

f. Universal use of a simply constructed deep underground shelter, a subway tunnel, or the sub-basement of a large building could eliminate the lethal hazard due to external radiation from fall-out completely, if followed by evacuation from the area when ambient radiation intensities have decayed to levels which will permit this to be done safely.

Table II

Total Isodose Contour: 500r from Fall-out to H+50 Hours

Yield (MT)	15	1	10	60
Downwind extent (mi)	180	52	152	340
Area (mi^2)	5400	470	3880	17,900

HOME OFFICE
SCOTTISH HOME DEPARTMENT

General Information

(All Sections)

CIVIL DEFENCE
POCKET BOOK NO. 3

LONDON
HER MAJESTY'S STATIONERY OFFICE
1960

Zone	*Dose-rate at H+48 hours*	*Summary of permissible and recommended action*
W	Less than 0.3 r.p.h.	Remain in refuge until released, which can be as soon as dose-rate falls to 0.3 r.p.h. or when fall-out is complete if the rate has not reached that figure.
X	0.3—3 r.p.h.	Remain in refuge until H+48 hours; then qualified release. Indoor workers to follow normal occupations, but not to exceed 4 hours per day in the open for the next 5 days. Outdoor workers would have to do half shifts to keep within this figure. At the end of a week the zone would be normal, except that all would be advised to be out of doors as little as possible, and not in any case to exceed 8 hours per day in the open for the next 3 months.
Y	3—10 r.p.h.	Remain in refuge until at least H+48 hours; then release under stringent control. For the next 12 days time in the oper should not exceed 2 hours per day. On this basis essential indoor workers should be able to get to their work, but outdoor work would remain suspended. After the first fortnight it would be possible to increase the essential time spent out of doors to 4 hours per day for the next three weeks, increasing this to 8 hours per day thereafter for the rest of the first year.
Z	10 r.p.h. or more	Remain in refuge until told to leave. All movement outside refuge in this zone would be dangerous. People should remain until instructions for clearance are given; they should then leave by the nominated route if they have means of transport—or wait in their refuge to be collected if they have not. The clearance operation might start after H+48 hours and removal from the Zone would be for at least 3 months.

HOME OFFICE
SCOTTISH HOME DEPARTMENT

MANUAL OF CIVIL DEFENCE

Volume I

PAMPHLET No. 1

NUCLEAR WEAPONS

LONDON
HER MAJESTY'S STATIONERY OFFICE
1956

Practical protection

88 Large buildings with a number of storeys, especially if they are of heavy construction, provide much better protection than small single-storey structures (see Figure 4). Houses in terraces likewise provide much better protection than isolated houses because of the shielding effect of neighbouring houses.

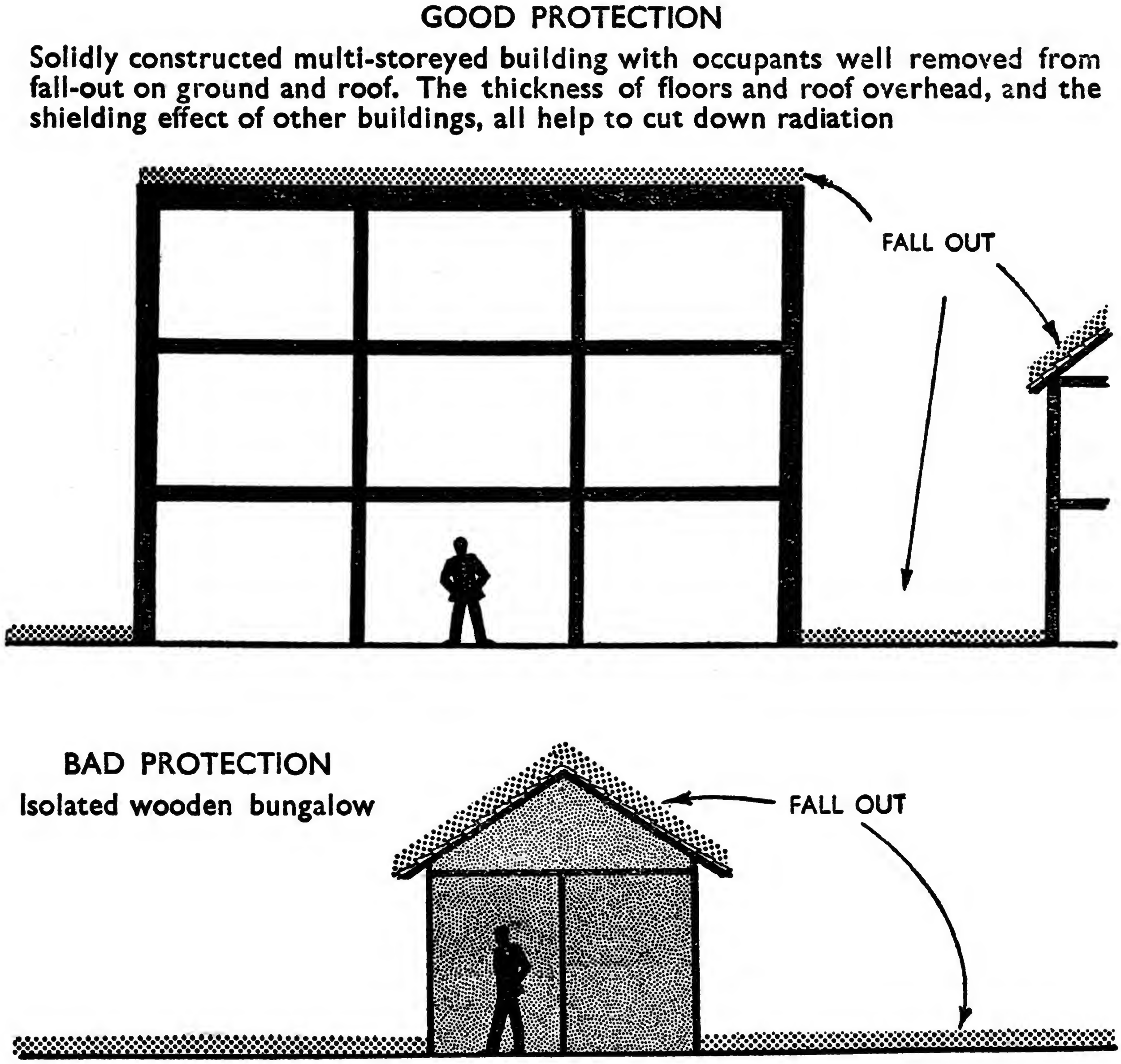


FIGURE 4

Examples of good and bad protection afforded by buildings against fall-out.

89 It is estimated that the protection factor (the factor by which the outside dose has to be divided to get the inside dose) of a ground floor room in a two-storey house ranges from 10 to about 50, depending on wall thickness and the shielding afforded by neighbouring buildings. The corresponding figures for bungalows are about 10–20, and for three-storey houses about 15–100. An average two-storey brick house in a built-up area gives a factor of 40, but basements, where the radiation from outside the house is attenuated by a very great thickness of earth, have protection factors ranging up to 200–300. A slit trench with even a light cover of boards or corrugated iron without earth overhead gives a factor of 7, and if 1 ft. of earth cover is added the

factor rises to 100. If the trench can be covered with 2 or 3 feet of earth then a factor of more than 200–300 can be obtained (see Figure 5).

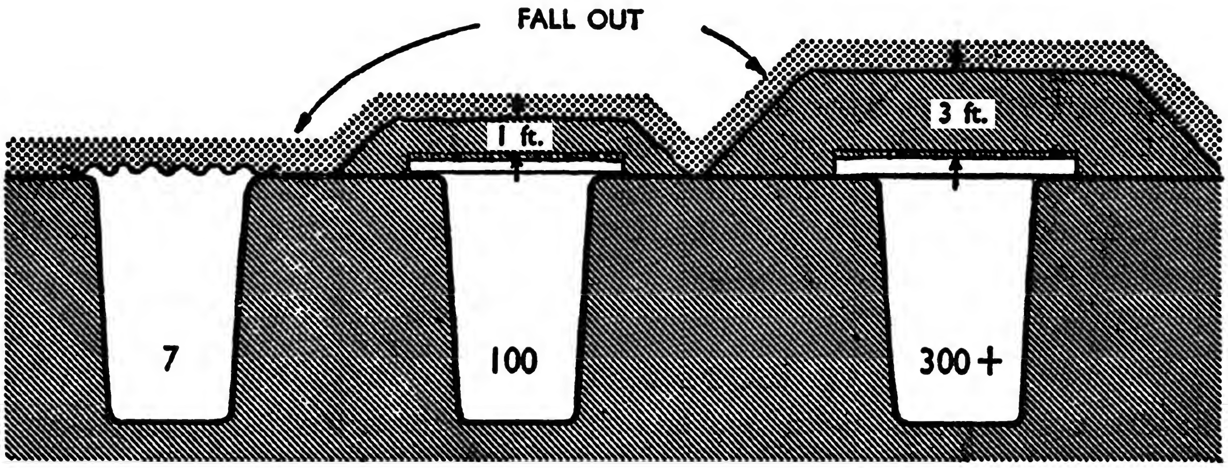


FIGURE 5

Protection factors in slit trenches (the factor by which the outside dose is divided to get the inside dose).

Choosing a refuge room

90 In choosing a refuge room in a house one would select a room with a minimum of outside walls and make every effort to improve the protection of such outside walls as there were. In particular the windows would have to be blocked up, e.g. with sandbags. Where possible, boxes of earth could be placed round an outside wall to provide additional protection, and heavy furniture (pianos, bookcases etc.) along the inside of the wall would also help. A cellar would be ideal. Where the ground floor of the house consists of boards and timber joists carried on sleeper walls it may be possible to combine the high protection of the slit trench with some of the comforts of the refuge room by constructing a trench under the floor.

Once a trap door had been cut in the floor boards and joists and the trench had been dug, there would be no further interference with the peace-time use of the room.

Estimated under-cover doses in the fall-out area

91 Taking an average protective factor of 40 for a two-storey house in a built-up area, the doses accumulated in 36 hours for the ranges referred to in the U.S. Atomic Energy Commission Report (paragraph 84) would have been:—

190 miles downwind	7½r	15 Megatons
160 ,, ,,	12½r	Bravo 1954
140 ,, ,,	20r	

which are all well below the lowest figure of 25r referred to in Table 1. At closer ranges along the axis of the fall-out, the doses accumulated in 36 hours would have been much higher, but over most of the contaminated area—with this standard of protection—the majority of those affected would have been saved from death, and even from sickness, by taking cover continuously for the first 36 hours.

5. Radiation sickness

Assume dose incurred in a single shift (3–4 hours) by the "average" man, over the whole body:—

25 roentgens	—No obvious harm.
100 „	—Some nausea and vomiting.
500 „	—Lethal to about 50 per cent. people (death up to 6 weeks later).
800 „ or more	—Lethal to all (death up to 6 weeks later).

Note: If dose spread uniformly over 2–3 days, then 60 roentgens could be incurred with no more effect than 25 roentgens in a single exposure of 3–4 hours.

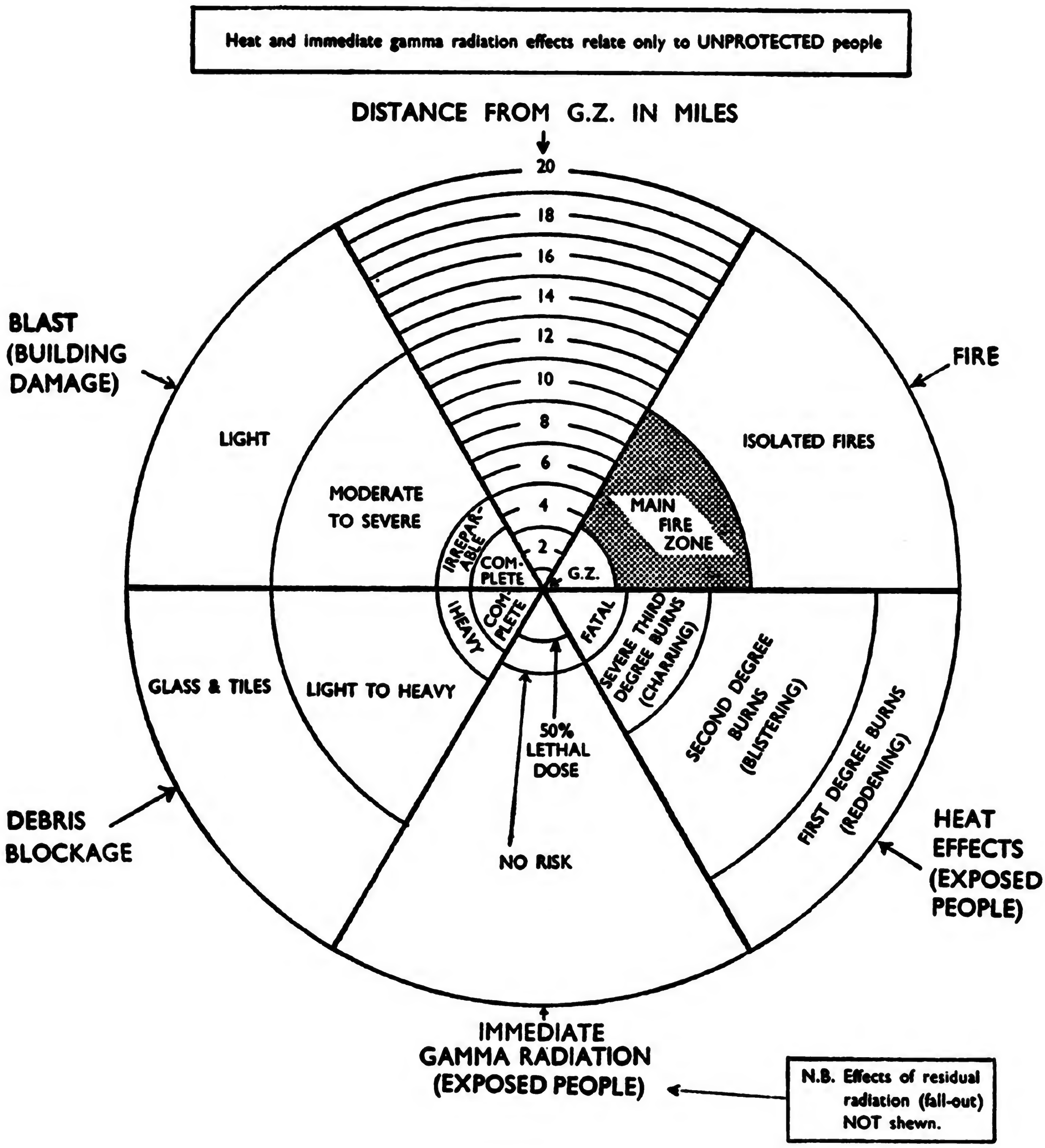


FIGURE 11

Combined effects (excluding residual radioactivity) from a 10 megaton ground burst bomb. Heat and immediate gamma radiation effects relate only to UNPROTECTED people.

HOME OFFICE

CIVIL DEFENCE
TRAINING MEMORANDUM No. 3

The Control of Civil Defence Operations under Fall-out Conditions (England and Wales)

LONDON
HER MAJESTY'S STATIONERY OFFICE
1959

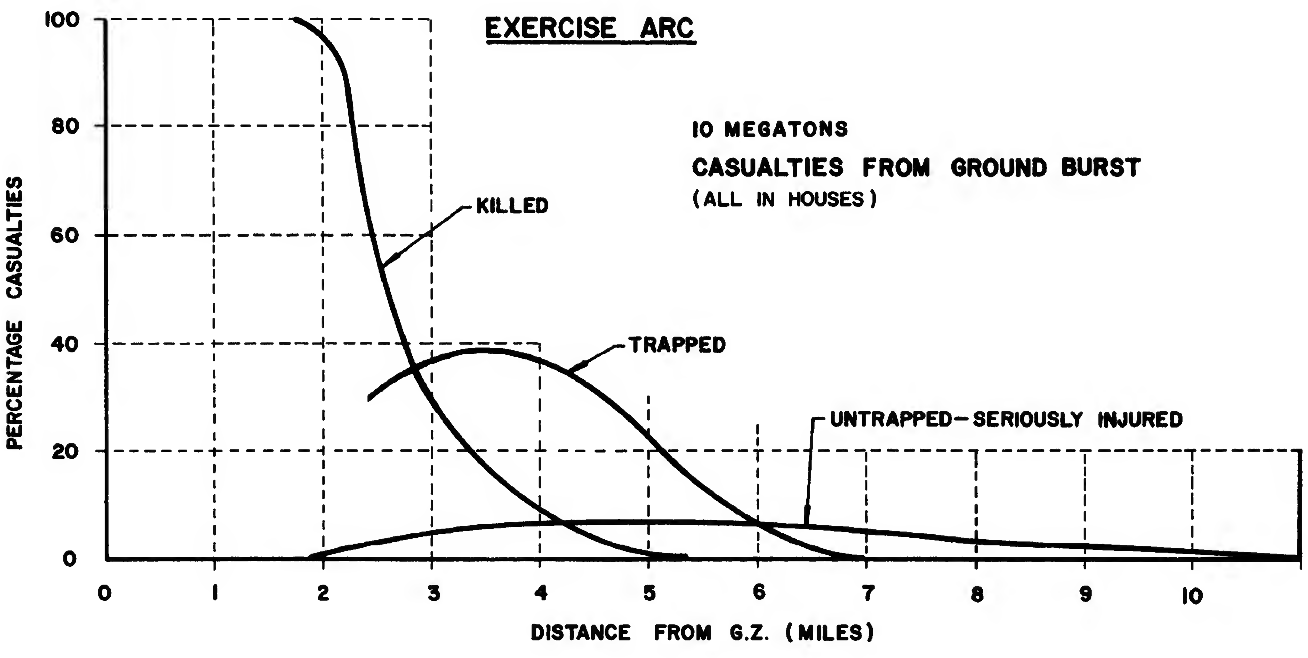
SIXPENCE NET

Civil Defence Training Memorandum No. 3, "The Control of Civil Defence Operations under Fall-out Conditions," U.K. Home Office, 1959

Paragraphs 6-14 explain that the need for rapid life-saving rescue and evacuation from the damaged areas near ground is to be balanced by the fallout gamma dose rate hazard to the civil defence workers; for optimum results first aid and rescue workers should move inwards (toward ground zero) at about the same speed the 10 R/hour gamma outdoor dose rate contour moves inward due to the natural radioactive decay of fallout (because fallout radiation decays rapidly, the dose rate at 48 hours being only about 1% of that at 1 hour):

"The balance of advantage would differ according to the nature of the work; but for the rescue and casualty services it is thought that the best results would be obtained from working at or about a dose rate of 10 R/hour, so that the wartime emergency dose [75 R] was used up in a single shift of about 8 hours. … Some forces, e.g. ambulances, could operate profitably where their dose was spread out over longer periods than 8 hours by working at lower dose rates than 10 R/hour. Others, e.g. reconnaissance parties with special responsibility for rapid penetration, might have to take their wartime emergency dose without heed to the 10 R/hour [fallout map pattern/contour] line and reduce their working period accordingly. … units would continue with their task … with reference only to the total dose accumulated on their dosimeters. … The radiological limit should be taken as the 1,000 R/hour at H + 1 contour which will be 10 R/hour line at H + 48 [due to the 100 fold decay of fallout radiation between 1 and 48 hours after a nuclear explosion] and so mark the limit to which life-saving forces can be expected to have penetrated by that time. …

"The task will be set by the number of casualties trapped, or seriously injured but untrapped … capable of being succoured within the first 48 hours. As soon as possible after ground zero, weight and nature of attack are known, the Controller should have casualty estimates made … This will be done by applying the population figures for the Sectors casualty percentages as shown on the graph (from Exercise ARC) attached as an appendix to this memorandum, which sets out, on the best evidence at present available [blast casualties from applying Blitz casualty data as a function of house damage to nuclear test data showing the amount of house damage versus distance from a nuclear explosion, which automatically takes account of the duration of the blast wave in nuclear explosions], the proportions of seriously injured, trapped and untrapped, to be expected at different distances from ground zeroes of bombs of varying power. … A single Forward Medical Aid Unit can be expected to deal with about 120 seriously injured an hour – say 1,000 in each shift – and to continue working throughout the operational period with only internal reliefs. … At the beginning of operations a 4-berthed ambulance can be expected to take about 1 hour on the round trip from ambulance loading point … A single casualty collecting party can handle and send to ambulance loading points about 12 seriously injured an hour, or, say, 100 per shift [8 hours]. … A single [light] rescue party [using slow manual methods used in 1941, without any of the tracked cranes and rescue dogs used to rapidly clear debris off casualties in 1944-1945, during the V1 and V2 attacks on London] can release two or three trapped persons an hour or, say, 20 per shift."



USNRDL-TR-1049
28 July 1966

REMOVAL OF SIMULATED FALLOUT FROM ASPHALT STREETS BY FIREHOSING TECHNIQUES

by

L.L. Wiltshire
W.L. Owen

In general, removal effectiveness improves with increased particle size range and increased mass loading. For the expenditure of an effort of 4 nozzle-minutes (12 man-minutes) per 10^3 ft^2, results ranged as follows:

Particle Size Range (μ)	Nominal Mass Loading (g/ft^2)	Removal Effectiveness (Residual Fraction)
44 - 88	4.0	0.16
	24.0	0.07
350 - 700	4.0	0.005
	24.0	0.003

U.S. NAVAL RADIOLOGICAL DEFENSE LABORATORY

SAN FRANCISCO · CALIFORNIA 94135

FALLOUT DECONTAMINATION, RETENTION AND UPTAKE

'A number of factors make large-scale decontamination useful in urban areas. Much of the area between buildings is paved and, thus, readily cleaned using motorized flushers and sweepers, which are usually available. If, in addition, the roofs are decontaminated by high-pressure hosing, it may be possible to make entire buildings habitable fairly soon, even if the fallout has been very heavy.' – Dr Frederick P. Cowan and Charles B. Meinhold, *Decontamination,* Chapter 10, pp. 225-40 of Dr Eugene P. Wigner (editor), *Survival and the Bomb,* Indiana University Press, Bloomington, 1969.

Measured Efficiency of Decontamination by Firehosing Dry Fallout Deposits*

1-hour dose rate:	300 R/hr	1,000 R/hr	3,000 R/hr
Fallout deposit:	100 g/m^2	330 g/m^2	1,000 g/m^2
Portland cement concrete	96%	98%	99.2%
Tar and gravel roof	97%	98%	99%
Galvanised steel	95%	98%	99.4%
Smooth painted surface	96%	99%	99.6%

**Radiological Recovery of Fixed Military Installations,* U.S. Army Chemical Corps technical manual TM-3-225, 1958. Firehosing uses 4 cm diameter hoses, each crewed by 2-4 people, and utilising 100 gallons/minute of water; each hose decontaminates 700 m^2/hour. The water pressure needed is 5 atmospheres. The fallout is flushed into underground drain sewers with the water.

According to fallout decontamination studies on paved areas at distances of 600-1600 m from the 1951 *Sugar* nuclear surface burst and *Uncle* shallow underground burst: 'High-pressure water hosing was found to be the most rapid and effective procedure tested... None of the tested procedures [which included dry sweeping and vacuum cleaning] resulted in significant contamination of the operator's protective clothing.' (J.C. Maloney, *Decontamination of Paved Areas,* weapon test report WT-400, chapter 5, 1952.)

Priority firehosing of residential areas would be needed where the 1-hour dose rate is between 500-3,000 R/hr. At lower dose rates, there will be few casualties in any case (200 R being assumed to produce a 'casualty'), while at higher dose rates the hazard to decontamination crews is considered excessive, so protection would there depend on radiation shielding or evacuation. Decontamination could begin when the outdoor dose rate had decayed to 10 R/hr, i.e., 1-5 days after detonation for 1-hour dose rates of 500-3,000 R/hr. People in these zones must remain under cover indoors until decontamination is done. (An American study by Stanford Research Institute, *Systems Analysis of Radiological Defense,* in 1958 assumed that 1% of the population would be available to staff decontamination crews, and that each crew member is allowed a dose of 100 R.)

A study of decontamination was done by J.A. Miles of the British Home Office Scientific Adviser's Branch in 1965, *The Value of Area Decontamination in Reducing Casualties from Radioactive Fallout,* SA/PR-97, Secret. Miles found that firehosing roads, pavements, and houses to reduce dose rates by a factor of 4 requires 57,000 litres of water and 37 human-hours of effort per kilometre length of terraced streets; but twice this water and effort is needed for streets of semi-detached houses with front gardens. About 620 people live in each kilometre length of terraced streets, but only about 310 people live in each kilometre length of semi-detached housing. Terraced streets are thus the decontamination priority.

Several tested techniques are available to decontaminate different surfaces. Roads, paved areas, building surfaces, vehicles, aircraft and ships can be decontaminated by water hosing. Farmland requires a different technique. In fallout tests, single-pass deep-ploughing to a depth of 20-25 cm reduced the above-ground gamma radiation level from the fallout by 85%; using a 125 horse-power tractor with a 3-share plough, 3,250 m^2/hour was deep-ploughed. (*Radiological Recovery of Fixed Military Installations,* U.S. Army Chemical Corps technical manual TM-3-225, 1958.) Fallout is deep-ploughed to a depth below the root length of the crops, or alternatively the long-term agricultural uptake of strontium-90 and cesium-137 is simply diluted by adding chemically-similar calcium and potassium salts (respectively) to contaminated soil.

On smooth ground, it is possible to literally sweep away surrounding dry fallout with a broom, or to swill it down drains using an ordinary low pressure hose pipe. For concrete, 1 m height, and 0.7 MeV fallout gamma rays, the protection is:

Circular radius of decontaminated area (m)	Protection factor for the actual removal of fallout	Protection factor for just sweeping fallout to edge
5	1.4	1.3
10	1.8	1.5
15	2.0	1.8
30	2.7	2.3
60	4.1	3.5

There are three basic stages during radiological recovery from a nuclear war: (1) evacuation of old people with inadequate radiation shielding from heavy fallout areas if they are unable to improve their shielding sufficiently with sandbags, (2) sheltering in heavy fallout areas for a few days in the part of the house furthest from the roof and outside walls, with as much mass shielding of the inner refuge as possible while the intense danger falls sharply by natural radioactive decay, and (3) outdoor decontamination to avoid long-term exposure.

It is also possible to essentially avert the entire fallout problem by using the washdown system during fallout deposition. It is more effective to fix up a cheap water hose spray to clean the roof, walls, and surrounding urban paved areas while fallout is landing, than to spend money on sheltering, which will not remove a single fallout particle! Focus on expensive sheltering and measuring of radiation was a mistake made by Herman Kahn of the RAND Corporation in 1958, and has unfortunately overshadowed the more valuable discovery that if you do not waste time, you can just wash the fallout down the drain! (Kahn thought just in terms of an invisible radiation problem, not in terms of a physical fallout problem.) The continuous washdown system was tested on manned ships during the 1950s nuclear tests, having been developed after a study of the 1946 Bikini fallout problems. If you leave the fallout for weeks, decontamination becomes more difficult, because particles end up firmly lodged in crevices, and you also miss the benefit of reducing the intense early time hazard.

F.T. Underwood of the British Home Office Scientific Adviser's Branch, reported fallout adherence studies between 1961-5 (reports CD/SA-103 and CD/SA-125). Underwood glued sheets of 0.13 cm thick PVC plastic on to London house roofs. They were fully intact for 1 year and lost only 10% area coverage after another year during winter storms. PVC covered roofs retain few fallout particles, and are smooth enough that light rain or a small water spray will decontaminate them. For a 45-degree roof slope, 90% of the retained fallout on PVC is removed by just 1 litre/m^2 of water (i.e., 0.1 cm of rainfall).

Without PVC, much more water is needed to first fill up all the pits and crevices in the roof where fallout particles are lodged, before they can be carried away. Over 90% of fallout particles that exceeded 1 mm in diameter rolled or bounced quickly enough to overcome friction, and fell straight of roofs with a 45-degree slope. However, 95% of fallout particles smaller than 0.2 mm in diameter adhered to a 45-degree sloping ceramic tiled roof, because they slowly rolled into small pits and crevices where they lodged. R.T. Graveson reported in 1956 that the normal roof of a fallout-contaminated typical American house in the Nevada desert was decontaminated by 5 cm of natural rainfall, causing in a reduction of the gamma dose rate within the house by a factor of 15 (*Radiation Protection within a Standard Housing Structure,* Nevada Test Site report NYO-4714). Studies of skin decontamination by E. Neale and E. H. Letts's paper *Radiological Decontamination: Removal of Dry Fallout from Skin and Clothing,* British Chemical Defence Experimental Establishment, Porton Technical Paper PTP-R-16, 1958, showed that washing removed 100% of dry fallout particles of 100 microns or more in diameter, but only 97.5% of particles with a diameter of 20 microns. Denim overalls are decontaminated with 90% efficiency in 5 minutes by a washing machine (100 revolutions per minute with 1% detergent), for particle diameters exceeding 10 microns.

Research on Removing Radioactive Fallout From Farmland

By P. E. JAMES, *agricultural engineer, Physical Control Laboratory, Northeastern Region,* and R. G. MENZEL, *soil scientist, Water Quality Laboratory, Southern Region, Agricultural Research Service*

US Department of Agriculture, Agicultural Research Service, Technical Bulletin 1464 (1973)

TABLE 12.—*Experiment K: Percentage of radioactivity determined at various depths after deep plowing*

Sampling depth (inches)	Radioactivity of high-clay content Pullman soil	Radioactivity of sandy loam Elkton soil
	Percent	*Percent*
3	0.5	0.5
9	.3	.5
15	1.2	.7
21	1.7	4.2
27	6.2	29.2
33	27.4	62.6
39	61.4	2.0

A power-driven streetsweeper or scraper cutting 2 inches deep removes about 90 percent of the contaminant.

Decontamination should be accomplished before rainfall washes the radioactivity into low places where it is difficult to remove.

Decontamination can be accomplished by a scraper with a 12-foot blade at the rate of 100,000 square feet (2.3 acres) in 3.3 hours.

Application of a concrete or asphalt coating over the radioactivity is ineffective and only makes later pickup of radioactivity more difficult.

Burying radioactivity 3 feet deep with a large plow is costly and ineffective in reducing the uptake of radioactivity.

Planting through a contaminated surface which is then left untilled is an ineffective way to reduce the uptake of radioactivity.

The species of the crop is a highly significant factor in the uptake of radioactivity.

TABLE 13.—*Experiment L: Uptake of strontium-85 by mature crops grown with different tillage operations and a growth inhibitor*

Crop	Fraction of strontium-85 application taken up with different treatments		
	Rotary-tilled	Deep-plowed	Deep-plowed with Na_2CO_3
	Percent $\times 10^4$	*Percent* $\times 10^4$	*Percent* $\times 10^4$
Sugarbeet tops	640	300	39
Sugarbeet roots	910	780	76
Sudangrass fodder	780	450	52
Soybean straw	650	540	35
Soybean seed	67	56	6
Cabbage	1,130	560	154

each sample was recorded. Table 13 summarizes the uptake of strontium-85 by mature crops grown with different tillage operations and a growth inhibitor.

To investigate the effectiveness of a conventional-type streetsweeper in removing fallout from contaminated land, Experiment M was conducted during the fall (table 14). The following variables: Type of soil, sweeping procedures, type of broom material, and use of gutter broom were considered. Several practical factors make mechanical streetsweepers attractive. Sweepers leave the topsoil relatively undisturbed; they are maneuverable in corners and around objects, and are much less destructive than scrapers to hard surfaces such as roads.

The soil type and condition were important factors in decontaminating. It was easier to decontaminate sandy soil than silty loam during the initial passes. Four passes were required on silty loam soil to achieve 90-percent decontamination, whereas, only three were required on a sandy soil. The fields were decontaminated after a rain and, consequently, were wet. Other results might occur from sweeping dry fields.

Investigations of the sweeping procedures showed that after three passes, a point of diminishing return for the effort expended occurs. Nevertheless, 10 passes removed 99 percent of the contamination. The sweeper operated as effectively at high groundspeed as it did when going slower. Higher speeds are preferable since the operator receives less exposure.

A steel wire main broom was more effective than a plastic main

TABLE 14.—*Experiment M: Cumulative percentage of radioactivity reduced by repeated passes of a rotating-brush, mechanical street sweeper with different brooms* [1]

Broom material and sweeping procedure	Cumulative percent removed from Sassafrass sandy soil by indicated number of passes					Cumulative percent removed from Elkton silt-loam soil by indicated number of passes				
	1	2	3	4	10	1	2	3	4	10[2]
Main brooms	*Duplicative*					*Duplicative*				
Steel:										
Normal pass first	74	86	91	92	------	80	89	75	92	------
Suction pass first	73	86	92	94	100	84	95	85	94	------
Steel and gutter broom:										
Normal pass first	73	84	92	96	99	78	90	95	94	------
Suction pass first	52	75	93	90	------	50	54	77	78	------
Plastic:										
Normal pass first						38	51	70	90	------

[1] Data for results with the motorized vacuum sweeper and the rotary brush sweeper were recorded, but were not put in tabular form.

[2] The final part of this experiment was not conducted.

Health and Biology
(TID-4500, 11th Ed.)

THE ABSORPTION BY PLANTS OF BETA-EMITTING FISSION PRODUCTS FROM THE BRAVO SOIL

By

A. A. Selders, J. F. Cline and J. H. Rediske

Plant Nutrition and Microbiology Unit
Biology Section
Radiological Sciences Department

December 20, 1955

HANFORD ATOMIC PRODUCTS OPERATION
RICHLAND, WASHINGTON

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ABSTRACT

Barley and bean plants were grown to maturity (87 days) in soil from a Pacific island which contained fallout material from the Bravo shot. The leaves of bean and barley plants showed a concentration factor of 0.05 and 0.02, respectively, for the total beta emitters absorbed.

Leaves of both bean and barley plants had a higher concentration of fission products than did the fruit. Addition of nutrients to the soil decreased the uptake of fission products into the bean plant but had no effect on uptake into barley.

With the exception of those for cesium, concentration factors for the individual elements were comparable with values previously obtained in the laboratory using local soils. The concentration factor of 4-8 for cesium is over 20 times higher than is obtained using local soils. All values are determined on oven dried material.

TABLE 3

CONCENTRATIONS OF EMITTERS FOUND IN BRAVO SOIL AND 87-DAY-OLD PLANTS GROWN IN THIS SOIL, EITHER WITH OR WITHOUT ADDED NUTRIENT

		With Nutrient				Without Nutrient			
		Bean		Barley		Bean		Barley	
		Leaves	Pods	Leaves	Heads	Leaves	Pods	Leaves	Heads
Element	Soil mμc/g	CF*	CF	CF	CF	CF	CF	CF	CF
Rare Earths and yttrium	30	0.007	0.002	0.007	0.001	0.03	0.003	0.002	0.002
$Sr^{89 \text{ and } 90}$	0.2	7	1	3.5	0.5	15	2	5	0.4
Zr^{95}	4	0.008	0.005	0.01	0.003	0.03	0.008	0.02	0.01
Cs^{137}	0.1	1	2	Not determined	3	5	6	8	5
$Ru^{103-106}$	0.8	0.04	0.01	0.04	0.04	0.51	0.03	0.05	0.03

*Concentration factor expressed as $\frac{\mu c/g \text{ in plant part}}{\mu c/g \text{ in soil}}$ on dry weight basis.

HANFORD ATOMIC PRODUCTS OPERATION
RICHLAND, WASHINGTON

HW-33681

THE UPTAKE OF IODINE BY HIGHER PLANTS

A. A. Selders and J. H. Rediske
Plant Nutrition and Microbiology Unit
Biology Section

September 30, 1954

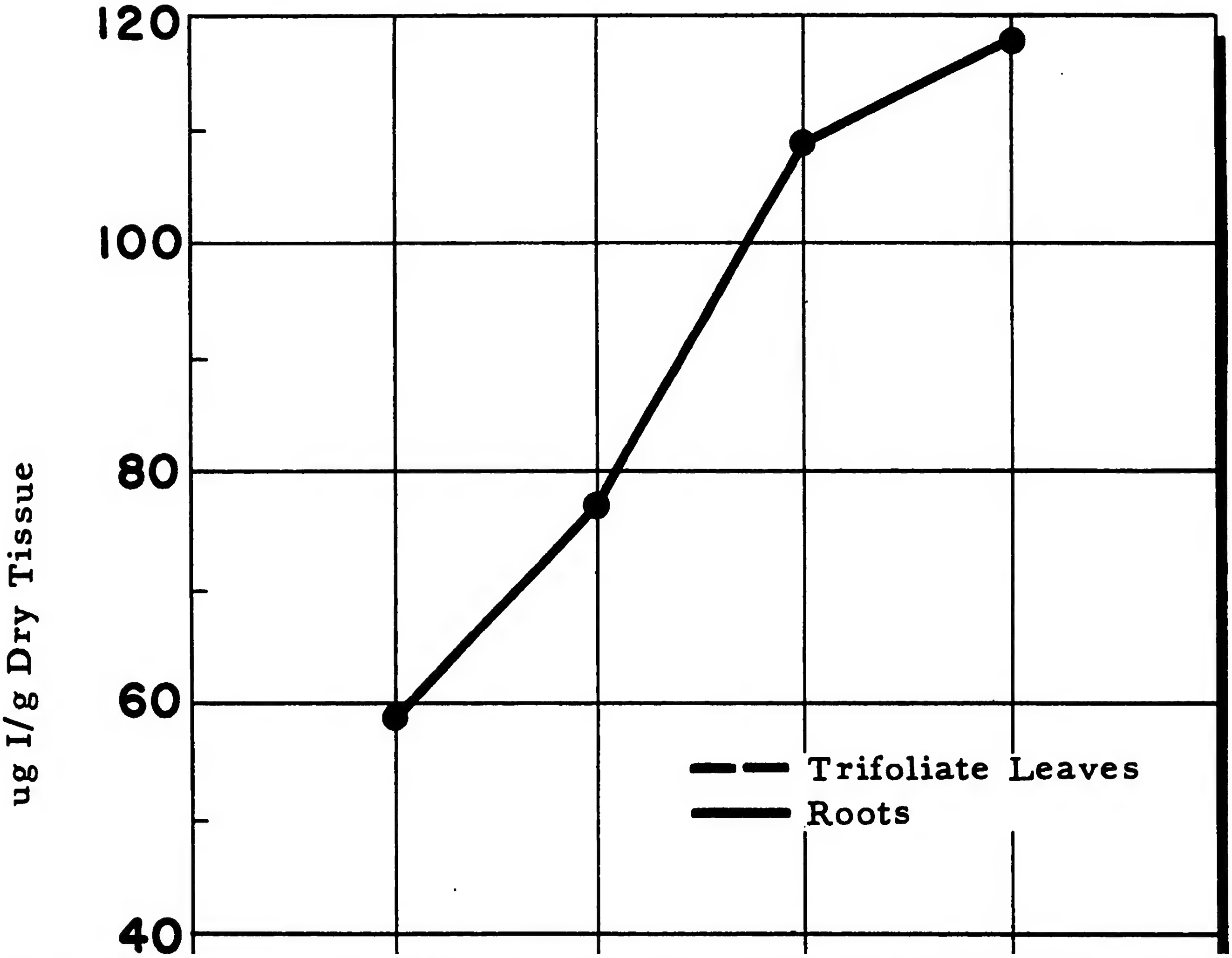
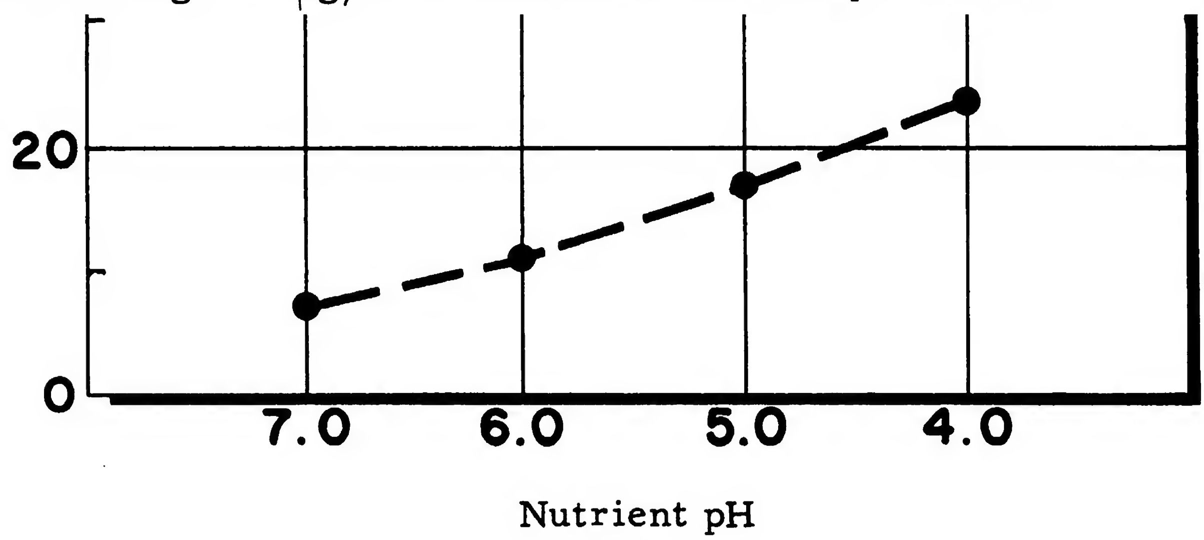


Figure 2 The uptake of iodine by the bean plant from nutrient solutions containing 0.1 μg/ml of iodine at various pH levels.



Survival of Food Crops and Livestock in the Event of Nuclear War

Proceedings of a symposium held at
Brookhaven National Laboratory
Upton, Long Island, New York
September 15–18, 1970

Sponsored by
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U. S. Atomic Energy Commission
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Editors

David W. Bensen
Office of Civil Defense
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Brookhaven National Laboratory

December 1971

U. S. ATOMIC ENERGY COMMISSION Office of Information Services

THE SIGNIFICANCE OF LONG-LIVED NUCLIDES AFTER A NUCLEAR WAR

R. SCOTT RUSSELL, B. O. BARTLETT, and R. S. BRUCE
Agricultural Research Council, Letcombe Laboratory, Wantage, Berkshire, England

ABSTRACT

The radiation doses from the long-lived nuclides ^{90}Sr and ^{137}Cs, to which the surviving population might be exposed after a nuclear war, are considered using a new evaluation of the transfer of ^{90}Sr into food chains.

As an example, it is estimated that, in an area where the initial deposit of near-in fallout delivered 100 R/hr at 1 hr and there was subsequent worldwide fallout from 5000 Mt of fission, the dose commitment would be about 2 rads to the bone marrow of the population and 1 rad to the whole body. Worldwide fallout would be responsible for the major part of these doses.

It is now widely recognized that long-lived fission products would make a negligible contribution to the radiation exposure of the population in heavily contaminated areas shortly after a nuclear attack. The external radiation dose would usually be dominant, and, if simple precautions were taken to avoid the superficial contamination of foodstuffs, the entry of ^{131}I into milk would cause the only important problem of dietary contamination. Thus, for example, infants probably would not receive doses of more than 0.1 rad to bone marrow from ^{90}Sr nor more than 0.01 rad from ^{137}Cs in the weeks after a nuclear attack if they were fed continuously with milk produced in an area where the external dose rate at 1 hr after detonation had been 100 R/hr. Doses to the thyroid from ^{131}I might, however, exceed 200 rads.

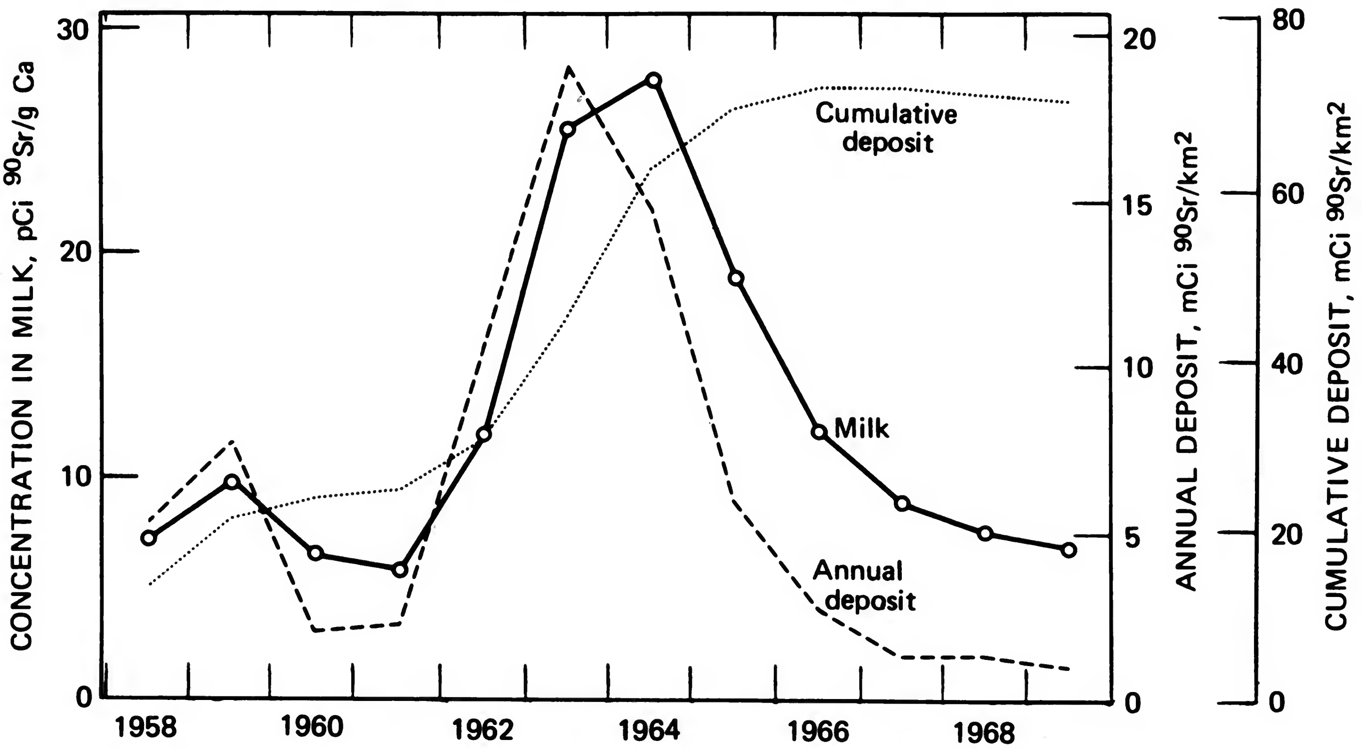


Fig. 1 Strontium-90 in fallout and milk in the United Kingdom, 1958 to 1969.

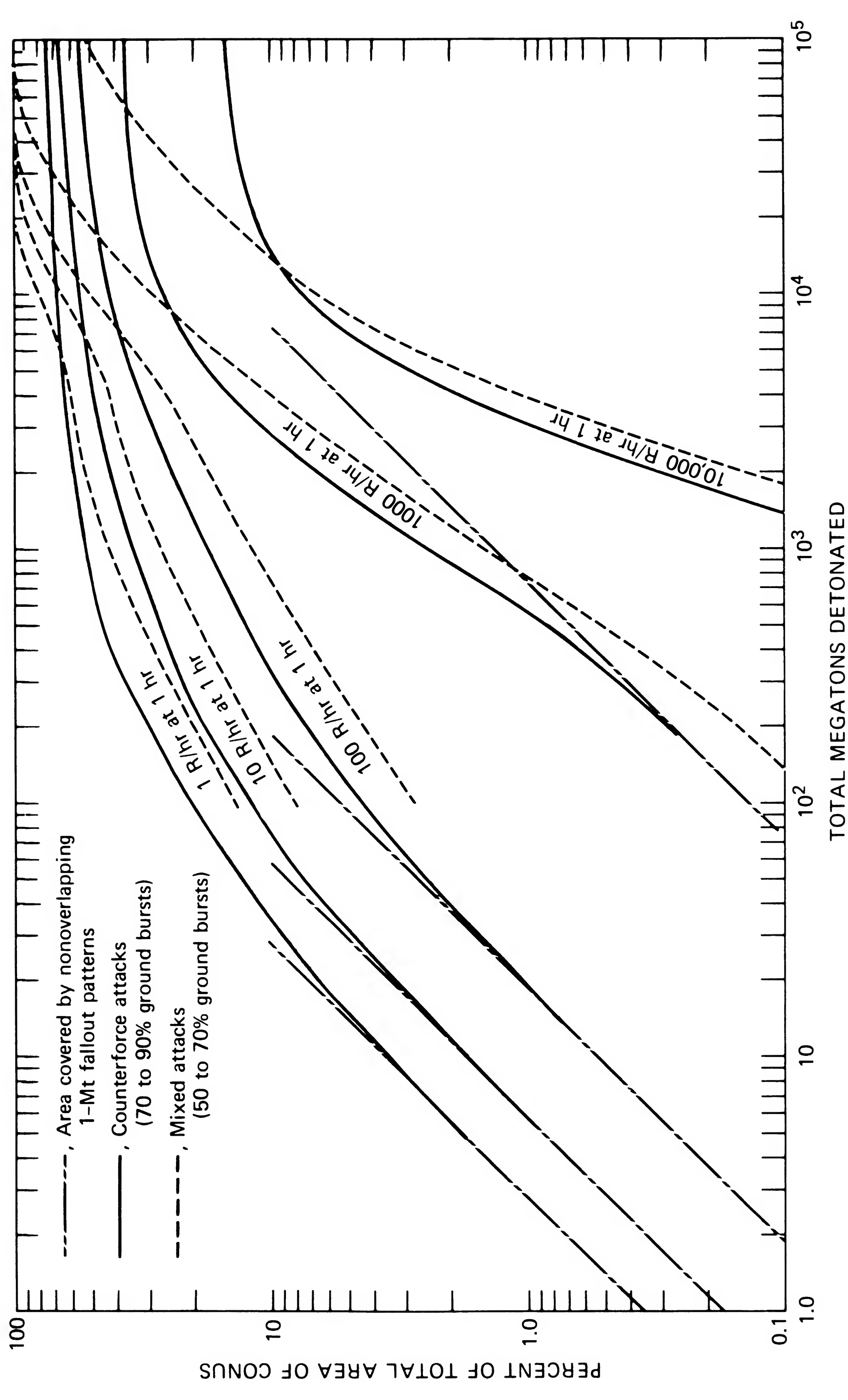
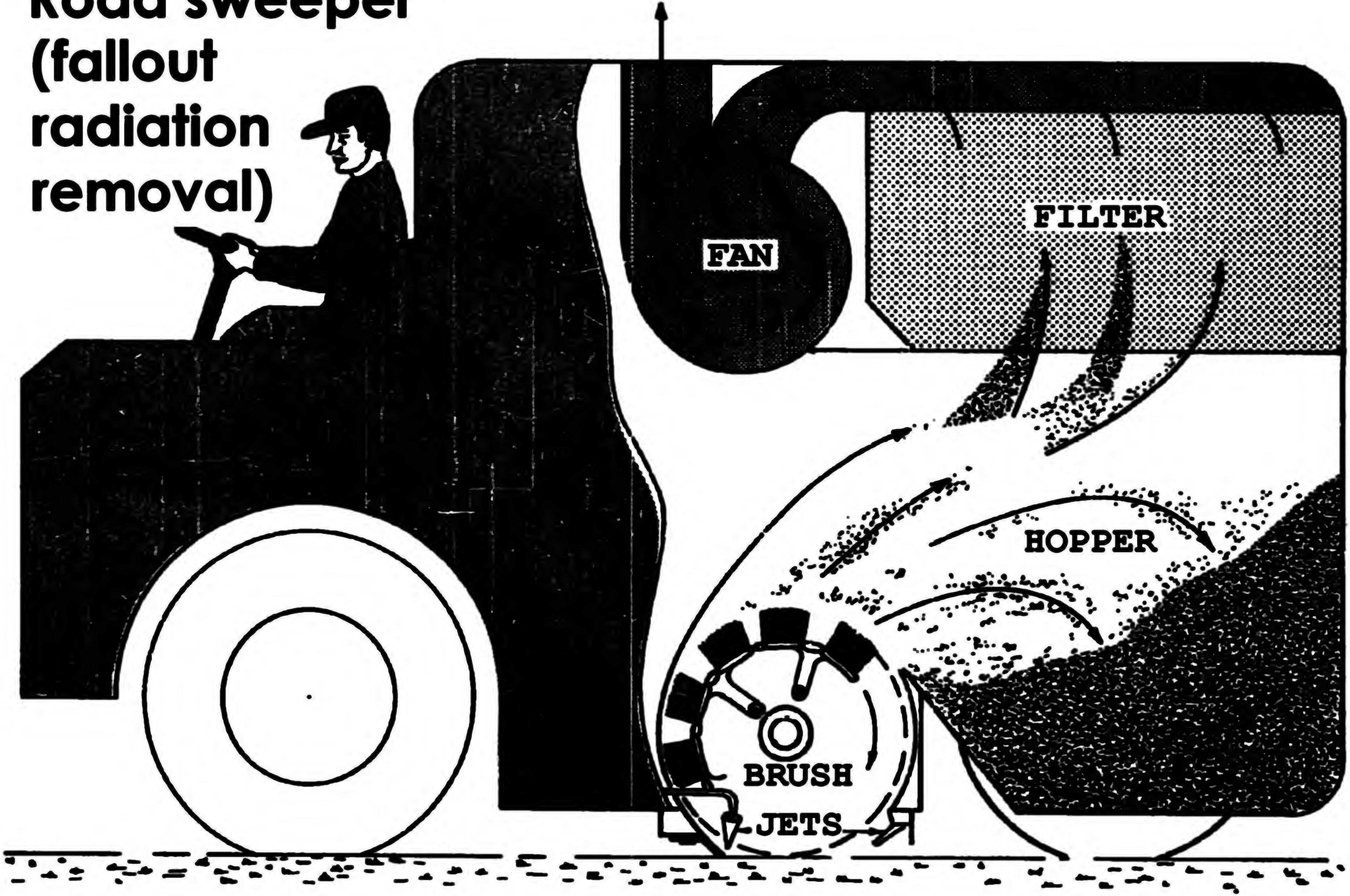


Fig. 1 Percent of area of the continental United States enclosed within selected I_S contours as a function of attack weight (50% fission weapons).

Road sweeper (fallout radiation removal)




TRINITY GROUND ZERO:
8000 R/hr at 1 hour
1.4 R/hr at
57 days
11 Sept. 1945

CLEAN BOMB: 3.53 MT (15% FISSION) ZUNI

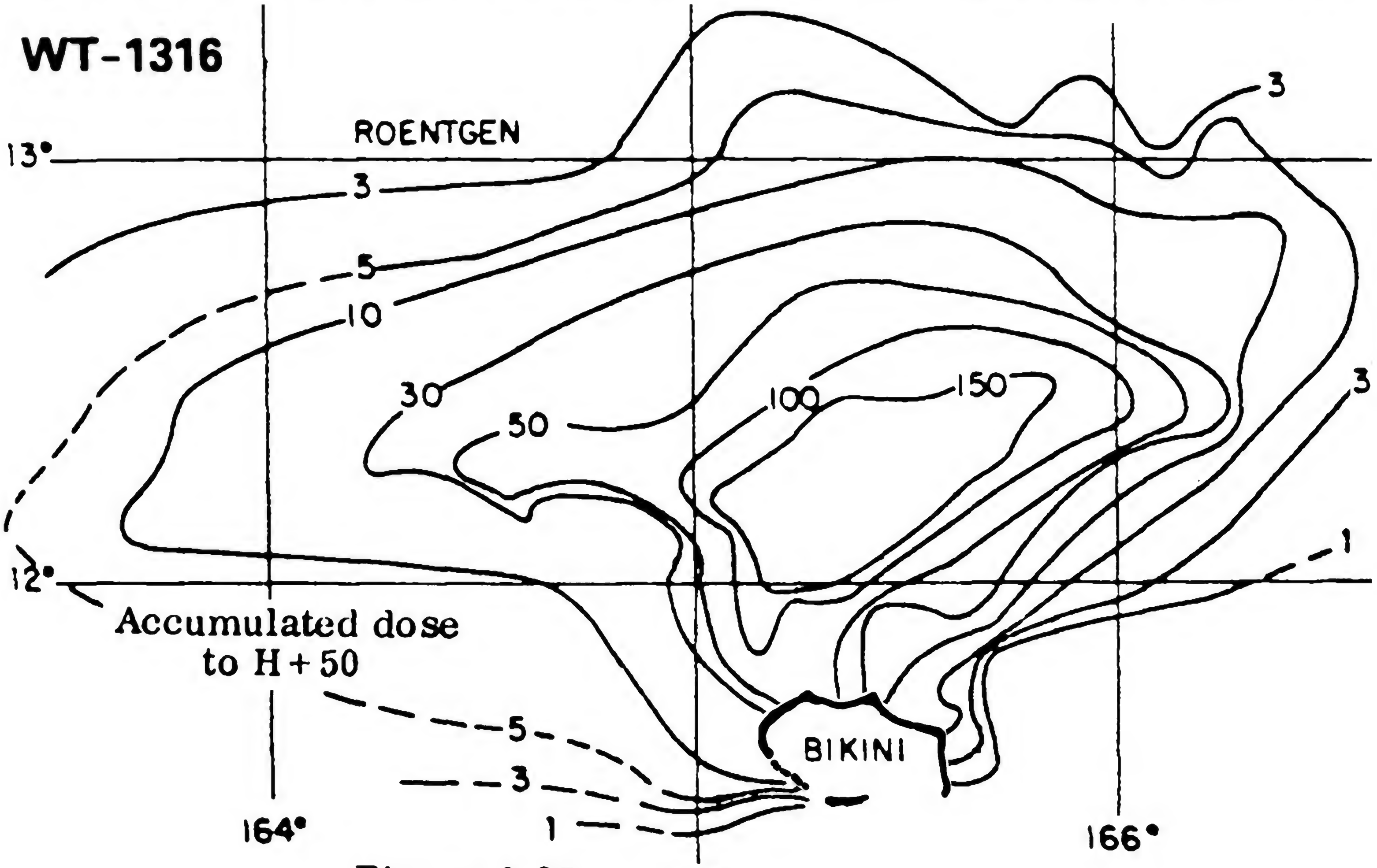


Figure 2.37

DIRTY BOMB: 5.01 MT (87% FISSION) TEWA

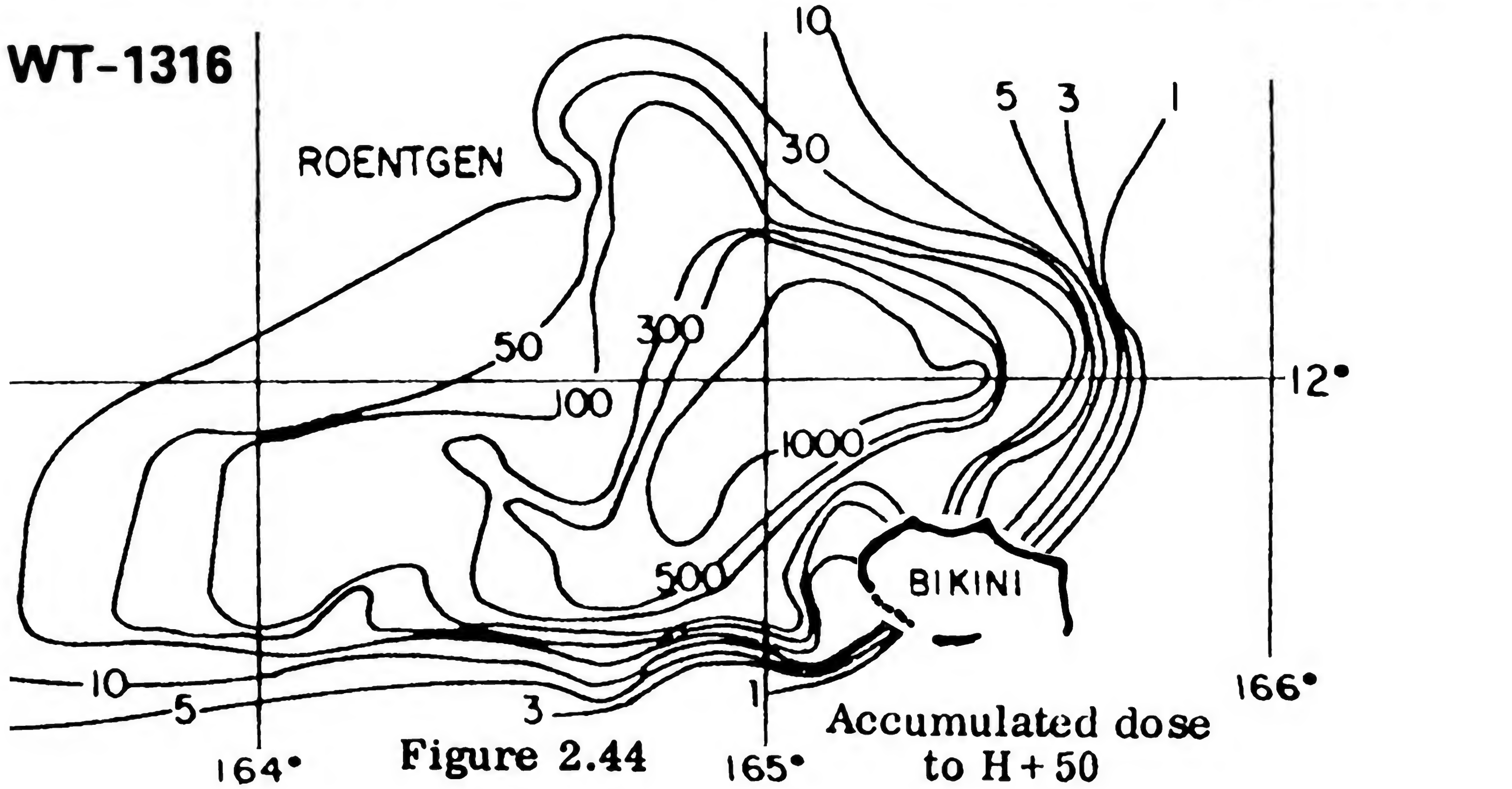


Figure 2.44

WT-1316

TABLE 2.11

	Navajo	Tewa
Total Yield, Mt	4.50	5.01
Fission proportion	5% (CLEAN)	87% (DIRTY)

H + 1 Hour Dose Rate (r/hr)	Area (mi^2) Within Contour	
1,000	25	450
500	55	1,050
300	80	1,550
100	310	3,500

Two-day Dose, R	Area (mi^2) Within Contour	
1,000	20	520
500	30	1,050
300	45	1,500
100	350	3,000

LAND SURFACE BURST

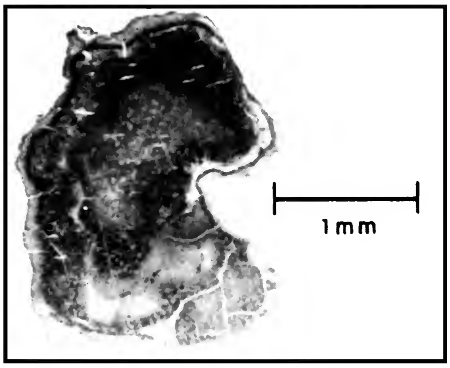
A Fallout Forecasting Technique With Results Obtained at the Eniwetok Proving Ground

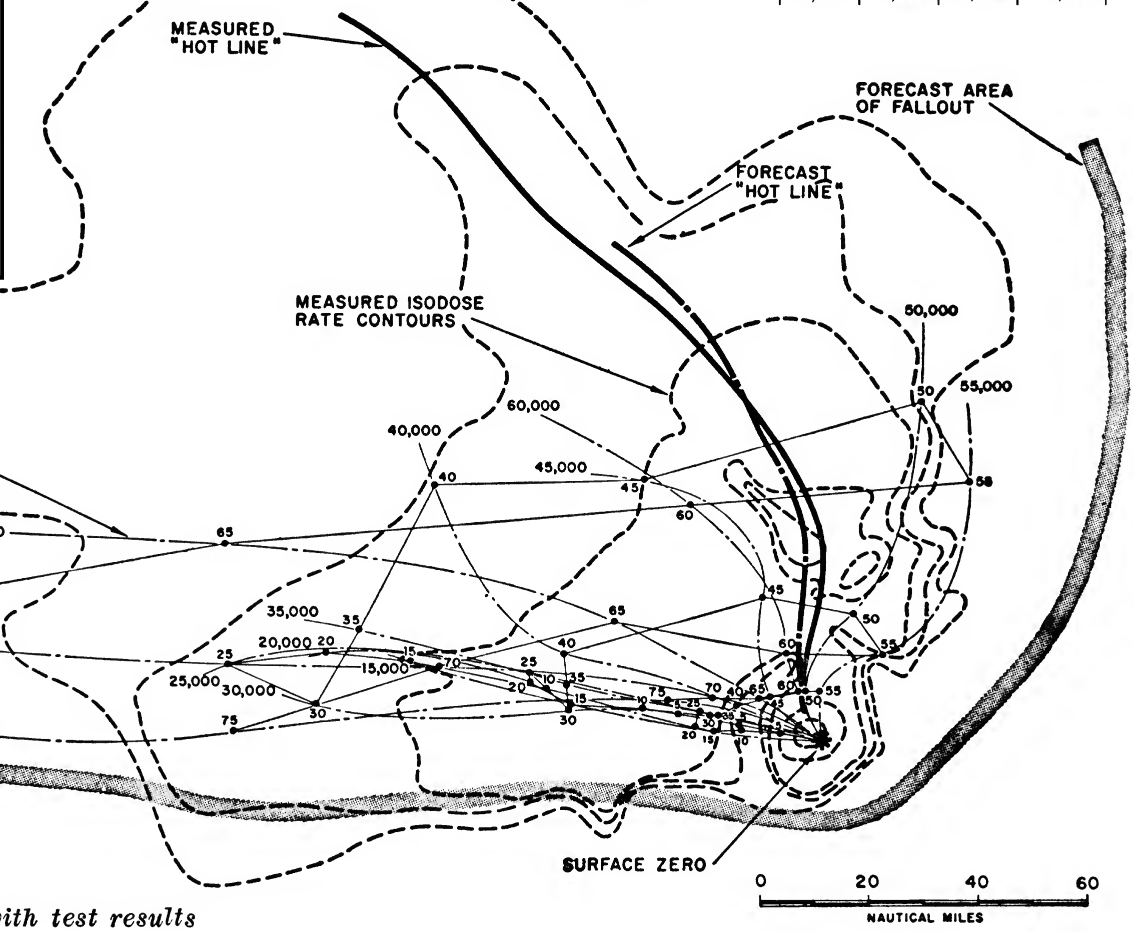
E. A. Schuert, USNRDL TR–139, United States Naval Radiological Defense Laboratory, San Francisco, Calif.

2.36 g/cu cm irregular in shape

Falling speeds (feet/hour)

Altitude	75 μ	100 μ	200 μ	350 μ
0	3,060	5,040	11,700	21,600
20	3,360	5,980	14,400	27,100
40	3,870	6,910	18,600	35,300
60	4,200	7,700	24,400	47,200
80	3,910	6,960	27,800	61,900

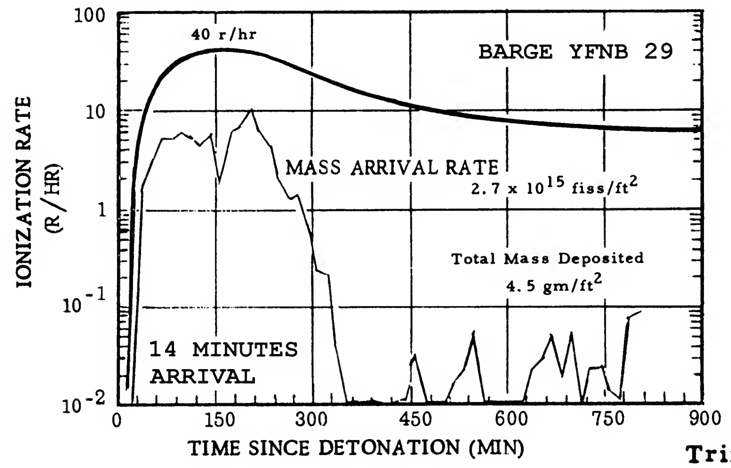




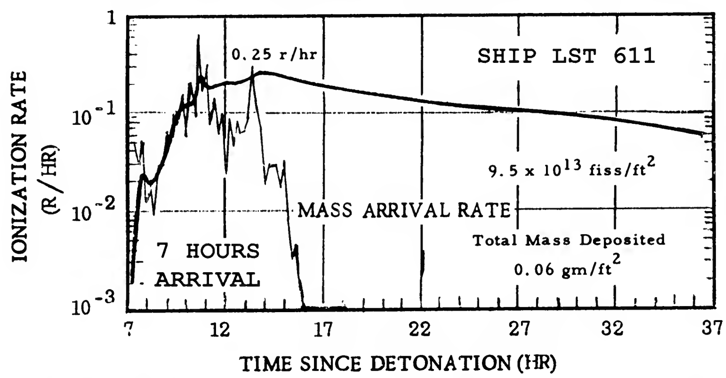
Comparison of fallout forecast with test results

HEIGHT LINE = DESTINATIONS FOR A FIXED HEIGHT OF ORIGIN FOR VARIOUS SIZES
SIZE LINE = DESTINATIONS FOR A FIXED PARTICLE SIZE FROM VARIOUS HEIGHTS
HOT LINE = HEIGHT LINE FROM BASE OF MUSHROOM DISC (MAXIMUM FALLOUT)

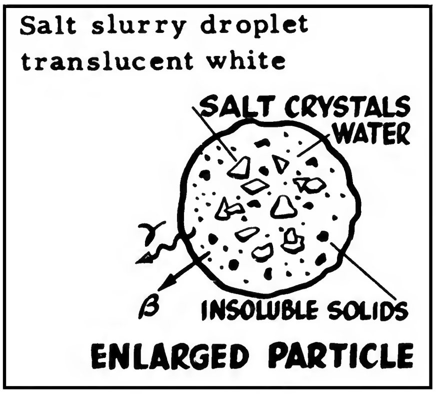
5 MT TEWA (87% FISSION), 7.84 STAT. MILES WSW



5 MT TEWA (87% FISSION), 59.3 STAT. MILES NW



Triffet, T. and LaRiviere, P. D.; Characterization of Fallout



WATER SURFACE BURST

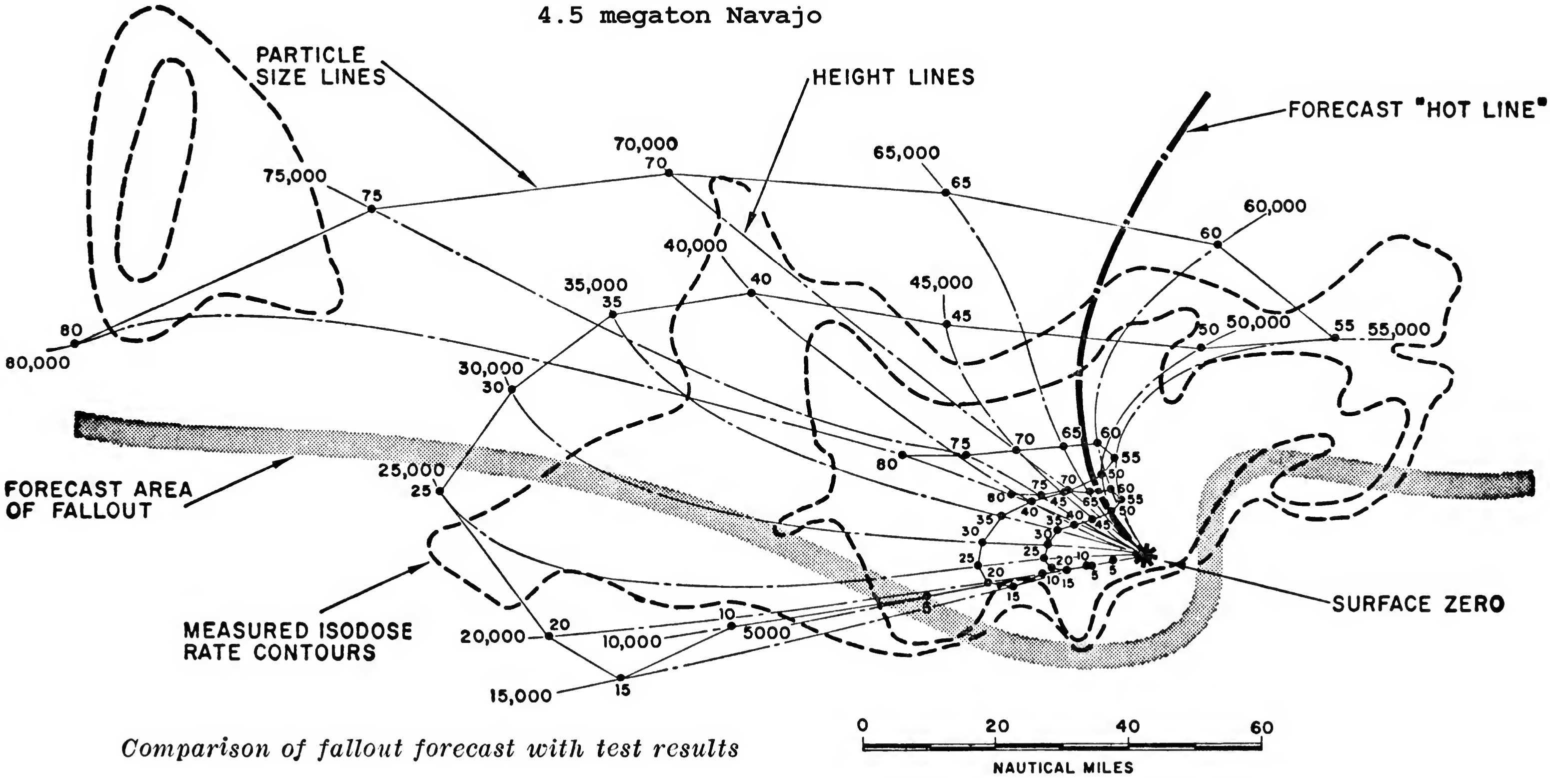
A FALLOUT FORECASTING TECHNIQUE WITH RESULTS OBTAINED AT THE ENIWETOK PROVING GROUND

E. A. Schuert, USNRDL TR-139, United States Naval Radiological Defense Laboratory, San Francisco, Calif.

Time variation of the winds aloft

In most of the observations made at the Eniwetok Proving Ground, the winds aloft were not in a steady state. Significant changes in the winds aloft were observed in as short a period as 3 hours. This variability was probably due to the fact that proper firing conditions which required winds that would deposit the fallout north of the proving ground, occurred only during an unstable synoptic situation of rather short duration.

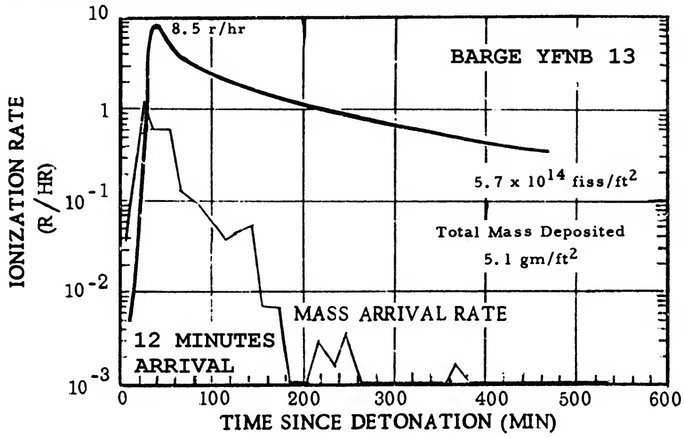
4.5 megaton Navajo



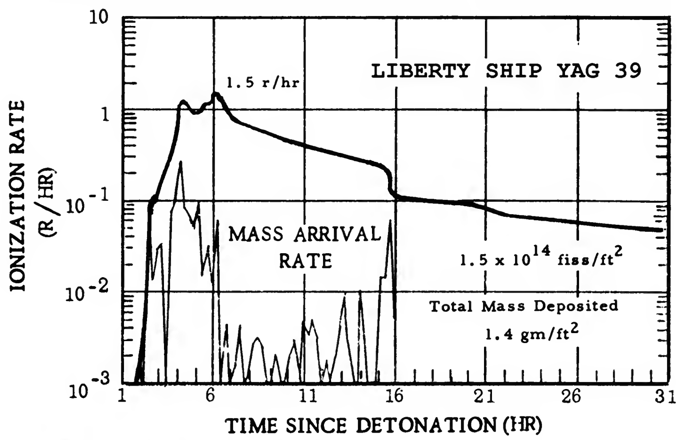
Comparison of fallout forecast with test results

HEIGHT LINE = DESTINATIONS FOR A FIXED HEIGHT OF ORIGIN FOR VARIOUS SIZES
SIZE LINE = DESTINATIONS FOR A FIXED PARTICLE SIZE FROM VARIOUS HEIGHTS
HOT LINE = HEIGHT LINE FROM BASE OF MUSHROOM DISC (MAXIMUM FALLOUT)

4.5 MT NAVAJO (5% FISSION), 7.54 STAT. MILES W



4.5 MT NAVAJO (5% FISSION), 21.0 STAT. MILES N

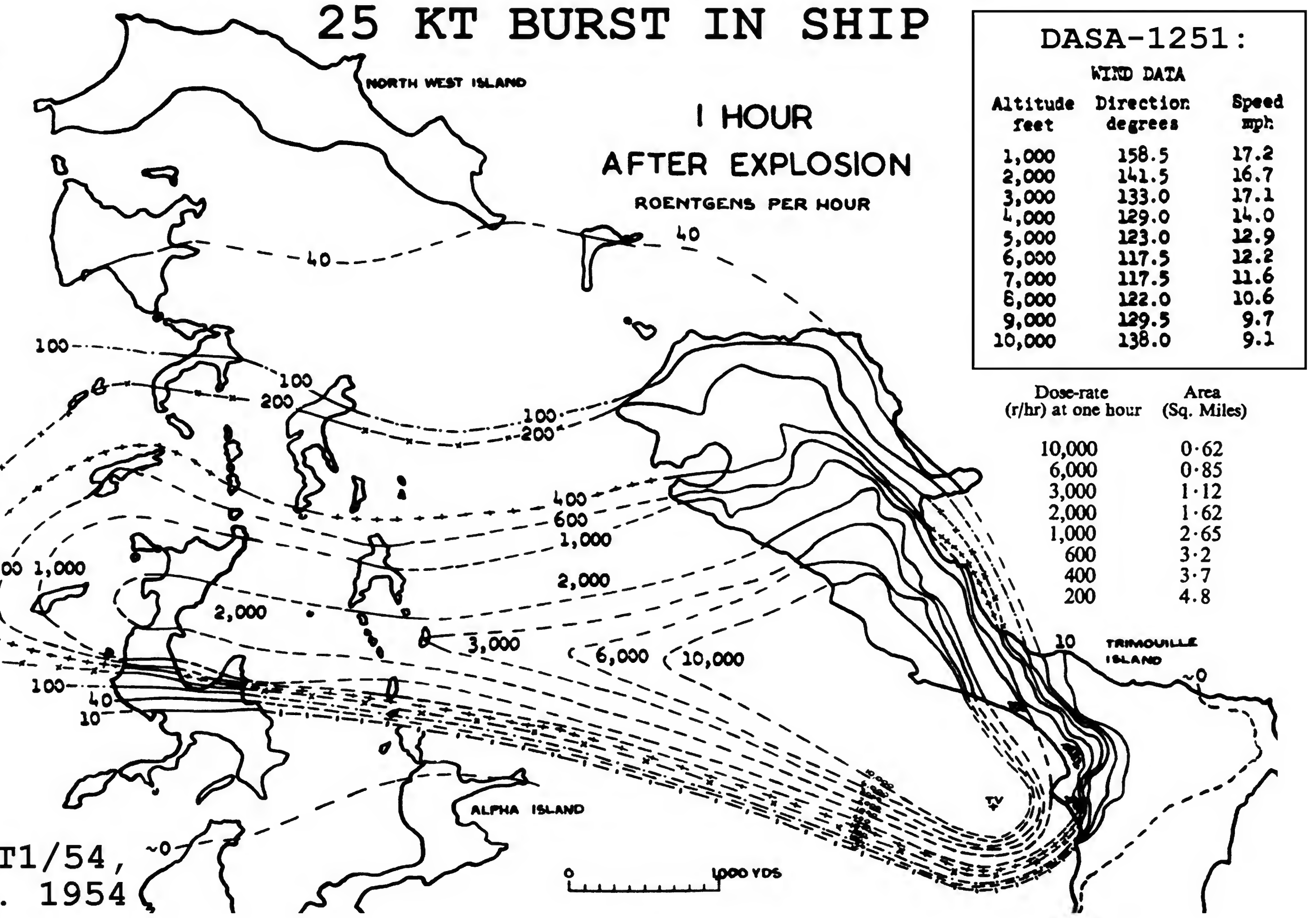


Triffet, T. and LaRiviere, P.D.; Characterization of Fallout, Project 2.63

OPERATION HURRICANE—THE DOSE-RATE CONTOURS OF THE RESIDUAL RADIOACTIVE CONTAMINATION

25 KT BURST IN SHIP

FIG. 7·2



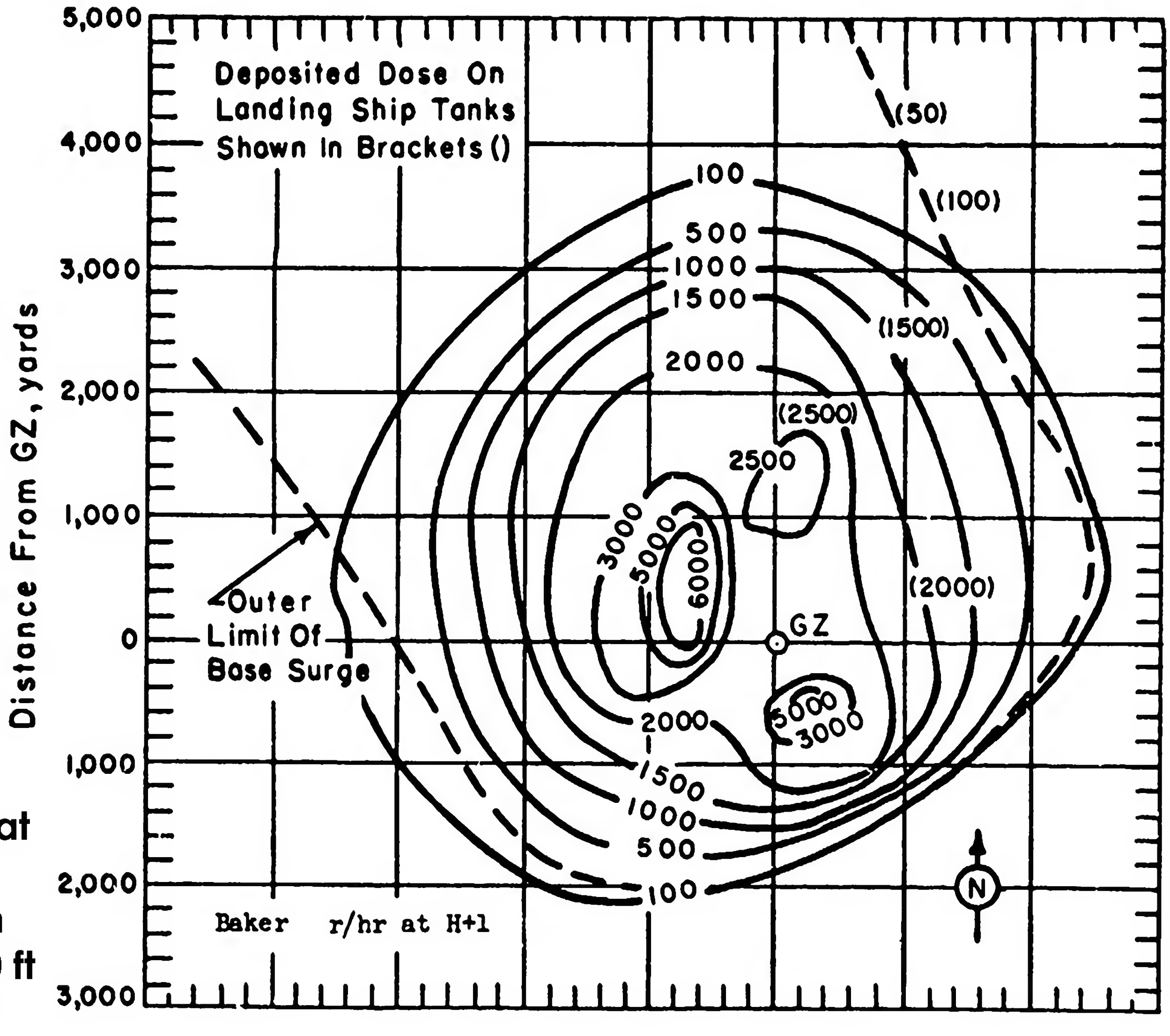
DASA-1251:

WIND DATA

Altitude feet	Direction degrees	Speed mph
1,000	158.5	17.2
2,000	141.5	16.7
3,000	133.0	17.1
4,000	129.0	14.0
5,000	123.0	12.9
6,000	117.5	12.2
7,000	117.5	11.6
8,000	122.0	10.6
9,000	129.5	9.7
10,000	138.0	9.1

Dose-rate (r/hr) at one hour	Area (Sq. Miles)
10,000	0·62
6,000	0·85
3,000	1·12
2,000	1·62
1,000	2·65
600	3·2
400	3·7
200	4·8

AWRE-T1/54,
27 Aug. 1954



23 kt at 90 ft depth in 180 ft water

AD-A995490

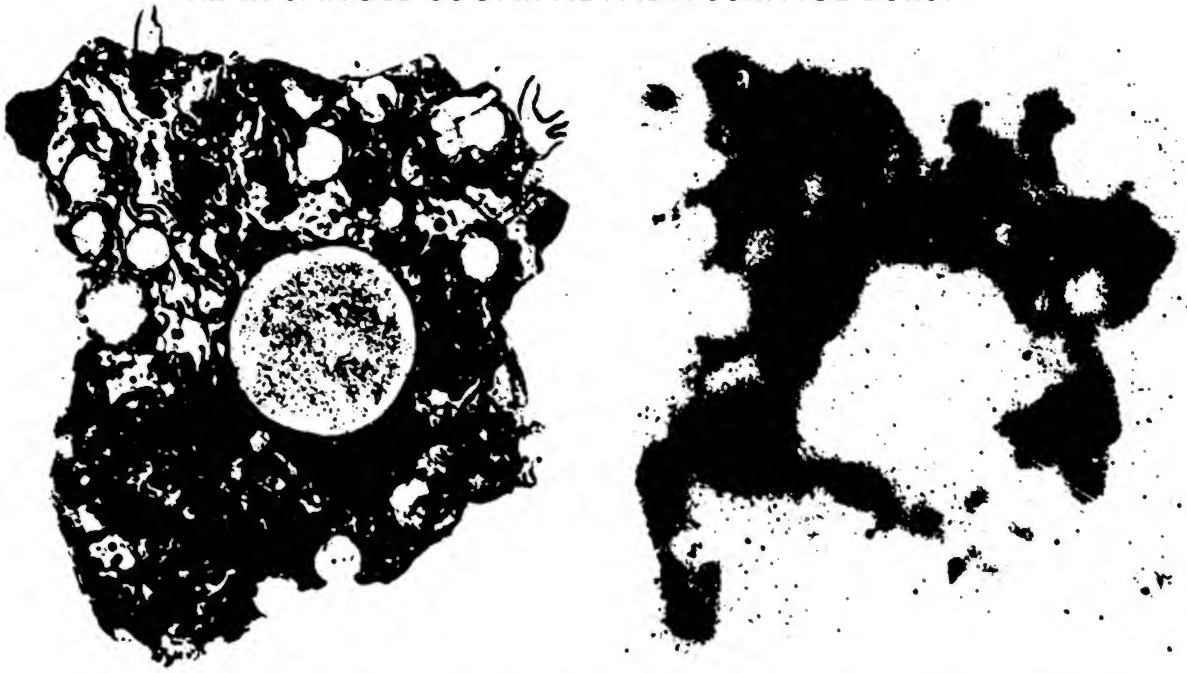
POR-2266 (WT-2266)

TABLE 4.1 AREAS ENCLOSED BY DOSE RATE CONTOURS

	0.018 kt	0.022 kt	0.5 kt	1.65 kt
Contour Dose Rate, I	Area Within Contour			
	Little Feller I	Little Feller II	Johnie Boy	Small Boy
r/hr	mi^2	mi^2	mi^2	mi^2
0.5	0.33	0.827	-	109.83
1.0	0.208	0.469	33.097	61.63
5.0	-	0.070	-	-
10.0	0.032	0.045	3.924	9.057
20.0	-	0.019	-	-
50.0	-	-	0.536	2.954
100.0	0.00478	0.005	0.214	1.200
200.0	-	-	-	0.285
1,000.0	-	-	0.0917	0.092
2,000.0	-	-	-	0.01665
10,000.0	-	-	0.0161	-
17,000.0	-	-	0.00537	-

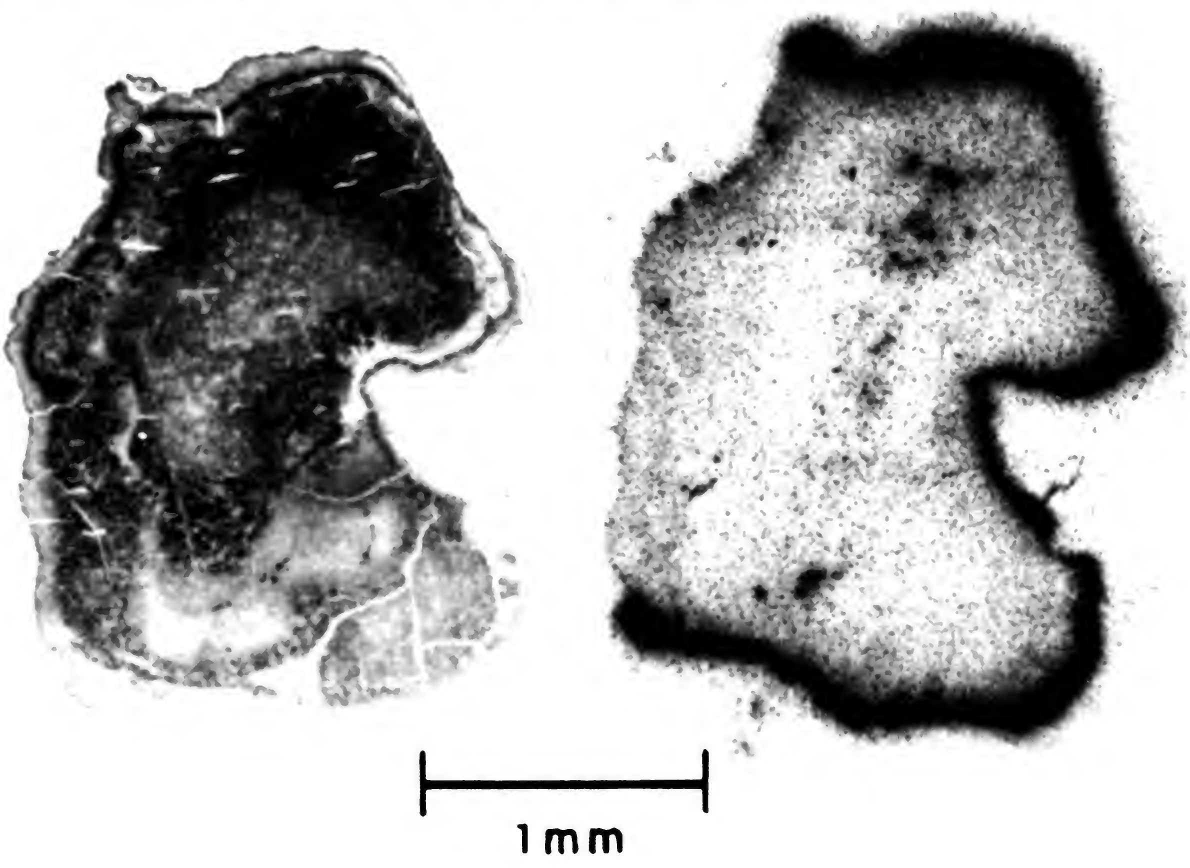
THIN SECTION AND RADIOGRAPH OF A FALLOUT PARTICLE FROM A SMALL-YIELD SURFACE SHOT AT THE NEVADA TEST SITE. THE PARTICLE IS A TRANSPARENT YELLOW-BROWN GLASS WITH MANY INCLUSIONS OF GAS BUBBLES AND UNMELTED MINERAL GRAINS. THE RADIOACTIVITY IS DISTRIBUTED IRREGULARLY THROUGHOUT THE GLASS PHASE OF THE PARTICLE

1.2 KT JANGLE-SUGAR NEVADA SURFACE BURST

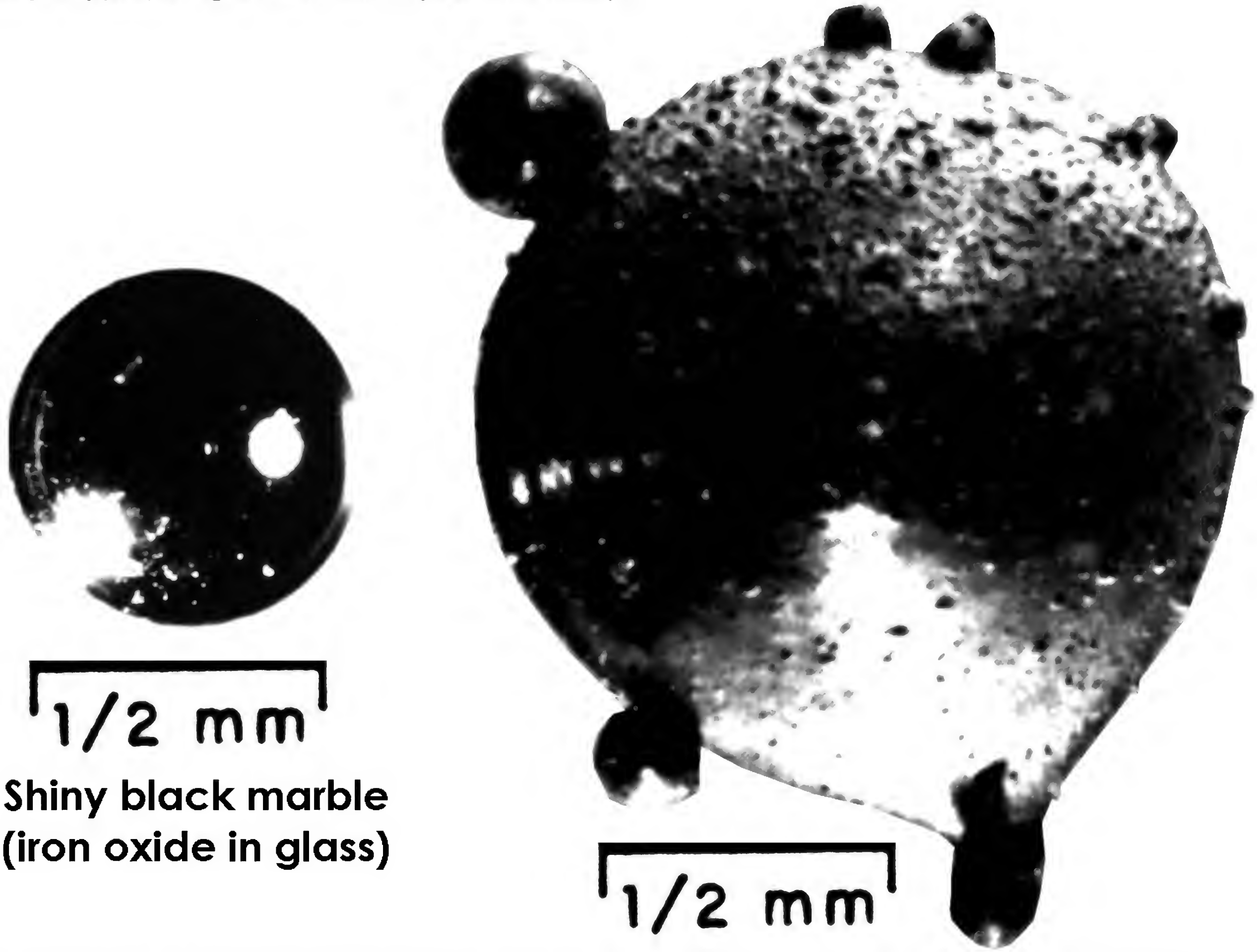


C.E. Adams, et al. The Nature of Individual Radioactive Particles. I. Surface and Underground A.B.D. Particles From Operation JANGLE. U.S. Naval Radiological Defense Laboratory Report, USNRDL-374, November 28, 1952

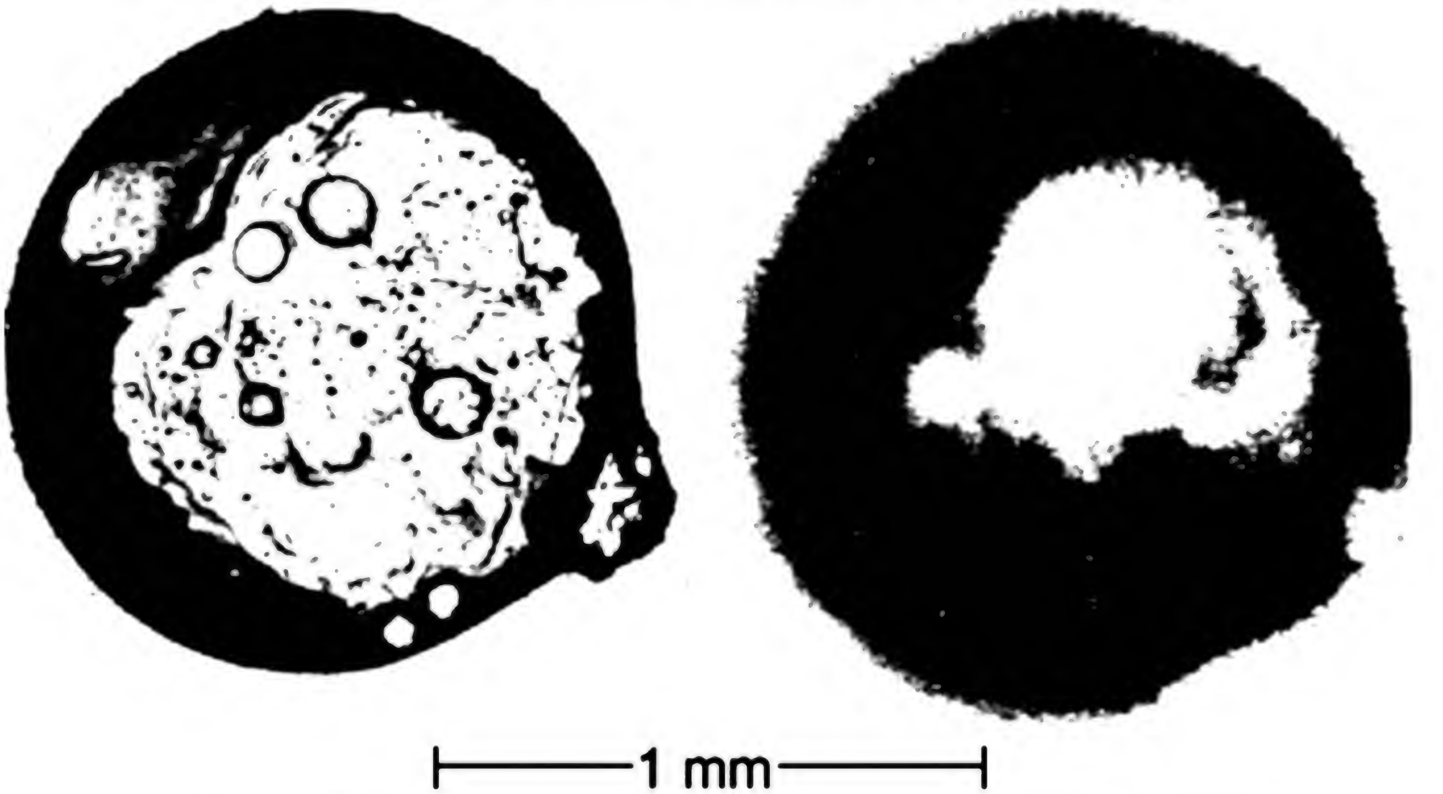
THIN SECTION AND RADIOGRAPH OF AN ANGULAR FALLOUT PARTICLE FROM A LARGE-YIELD SURFACE SHOT AT THE ENIWETOK PROVING GROUNDS. THIS PARTICLE IS COMPOSED ALMOST ENTIRELY OF CALCIUM HYDROXIDE WITH A THIN OUTER LAYER OF CALCIUM CARBONATE. THE RADIOACTIVITY HAS COLLECTED ON THE SURFACE AND HAS DIFFUSED A SHORT DISTANCE INTO THE PARTICLE



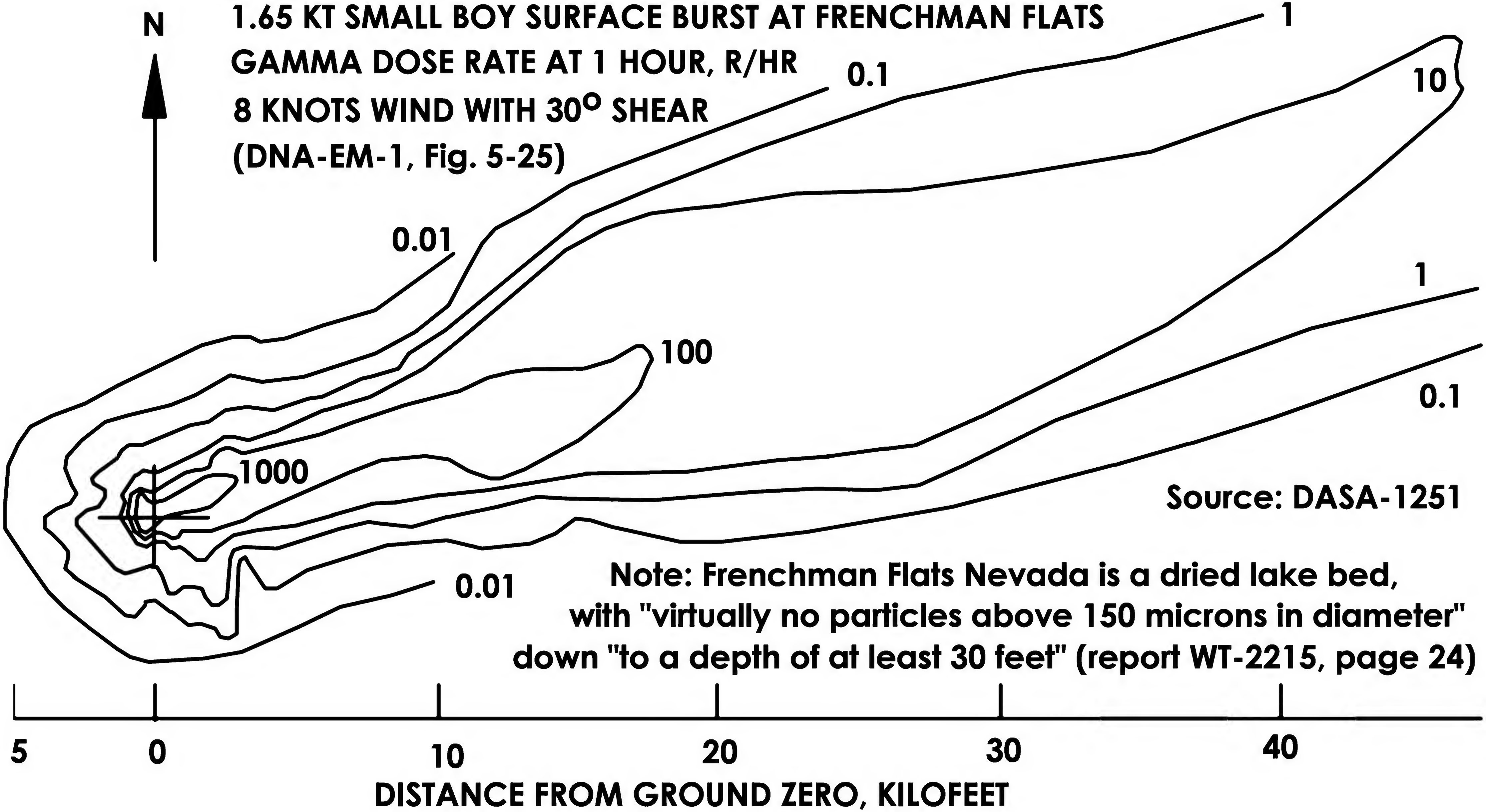
TWO FALLOUT PARTICLES FROM A TOWER SHOT AT THE NEVADA TEST SITE. THE PARTICLE ON THE LEFT IS A PERFECT SPHERE WITH A HIGHLY GLOSSY SURFACE; THE ONE ON THE RIGHT HAS MANY PARTIALLY-ASSIMILATED SMALLER SPHERES ATTACHED TO ITS SURFACE. BOTH PARTICLES ARE BLACK AND MAGNETIC AND HAVE A SUPERFICIAL METALLIC APPEARANCE.



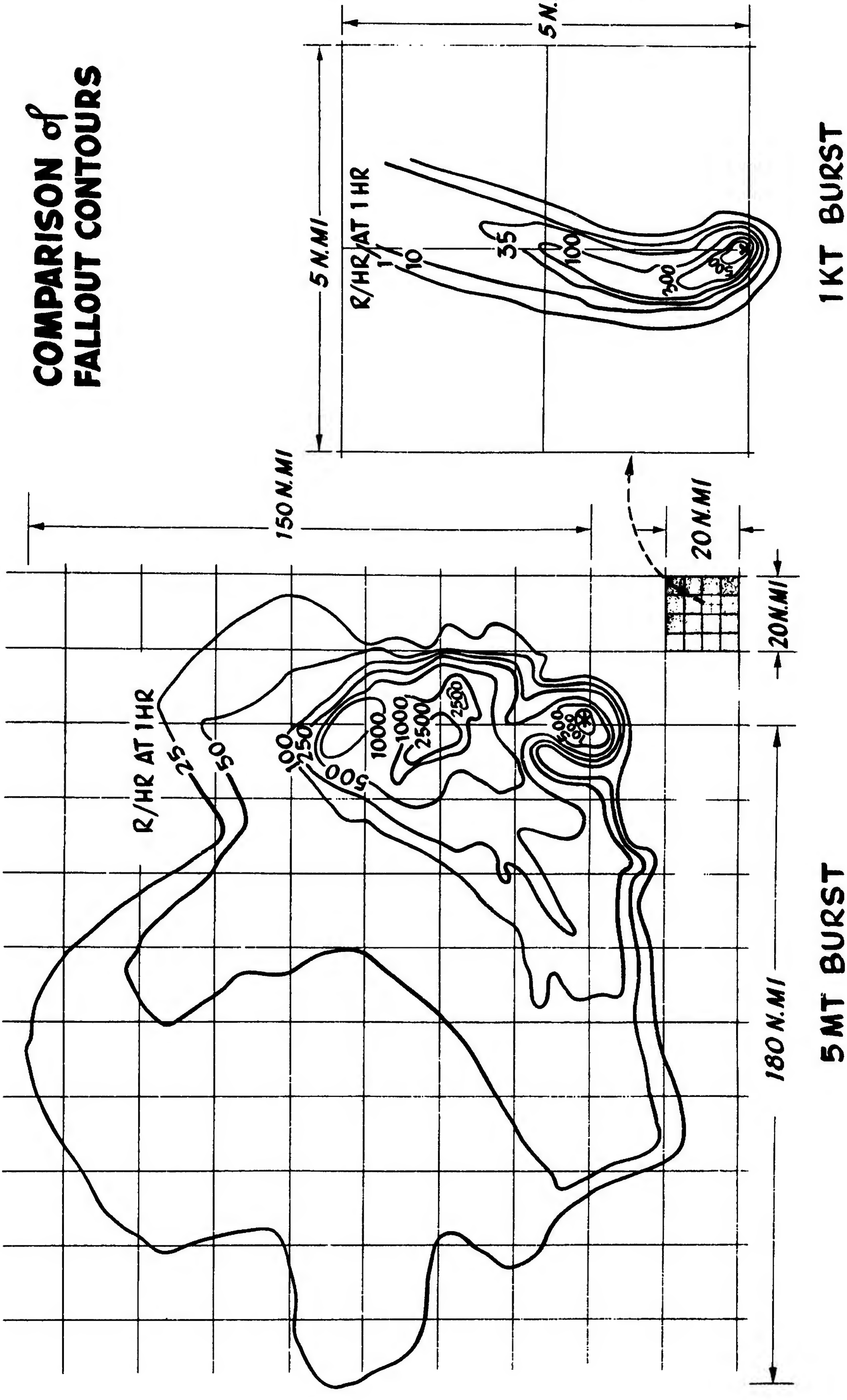
THIN SECTION AND RADIOGRAPH OF A FALLOUT PARTICLE FROM A MODERATE-YIELD TOWER SHOT AT THE NEVADA TEST SITE. THIS PARTICLE IS COMPOSED OF A TRANSPARENT GLASS CORE WITH A DARKLY COLORED IRON OXIDE GLASS OUTER ZONE. MOST OF THE RADIOACTIVITY IS CONCENTRATED IN THE OUTER ZONE

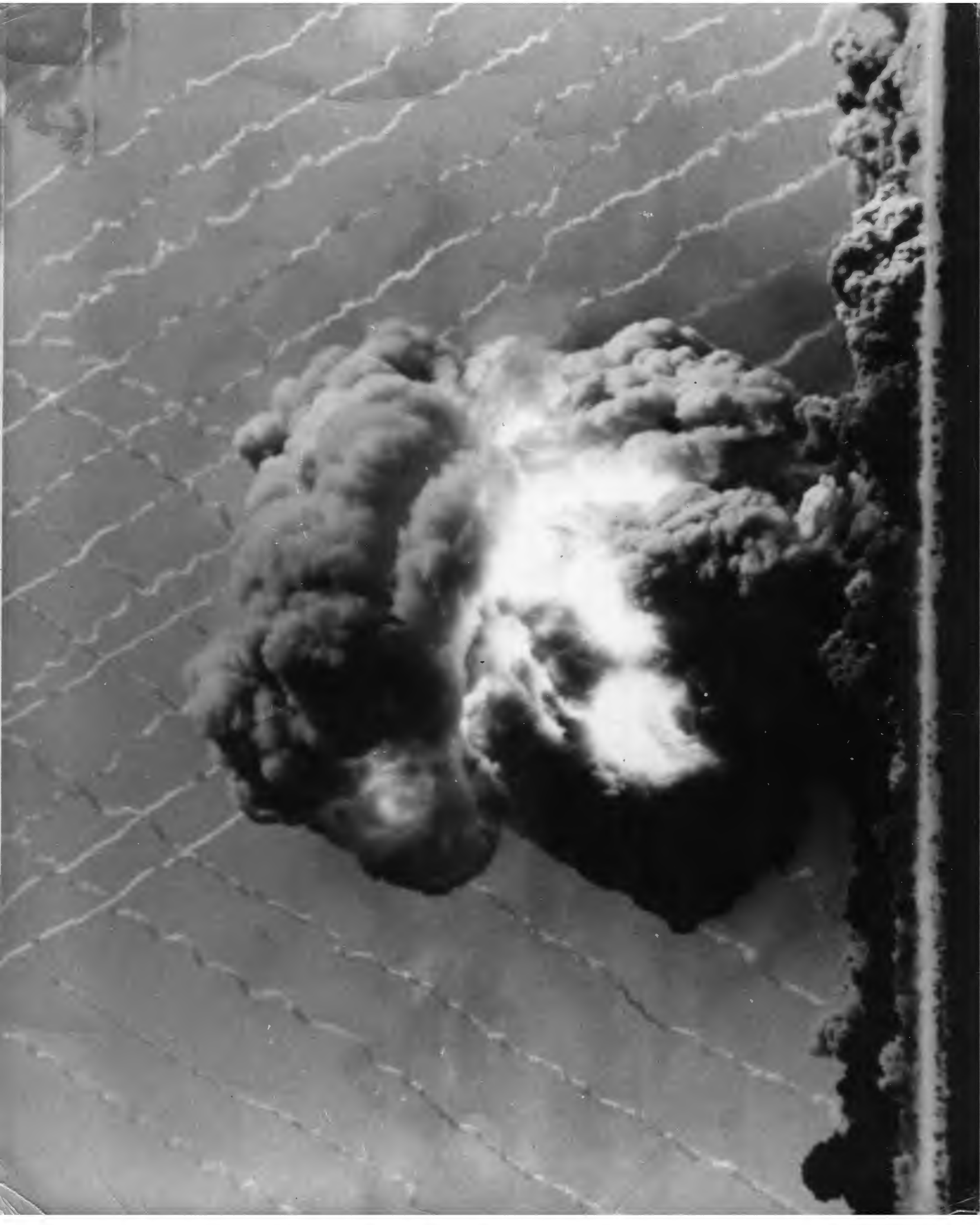


C.E. Adams. The Nature of Individual Radioactive Particles. IV. Fallout Particles From A.B.D. of Operation UPSHOT-KNOTHOLE. U.S. Naval Radiological Defense Laboratory Report, USNRDL-440, February 24, 1954


N
1.65 KT SMALL BOY SURFACE BURST AT FRENCHMAN FLATS
GAMMA DOSE RATE AT 1 HOUR, R/HR
8 KNOTS WIND WITH 30° SHEAR
(DNA-EM-1, Fig. 5-25)
1
0.1
10
0.01
100
1
0.1
1000
Source: DASA-1251
0.01
Note: Frenchman Flats Nevada is a dried lake bed,
with "virtually no particles above 150 microns in diameter"
down "to a depth of at least 30 feet" (report WT-2215, page 24)
5
0
10
20
30
40
DISTANCE FROM GROUND ZERO, KILOFEET

1.2 kt SUGAR (1951) and 5.01 Mt TEWA (87% fission)





Buffalo-1 at Maralinga, 1956. This nuclear test gave immense civil defence data.

Car (Land Rover jeep) in Maralinga desert, 600m from 15kt Buffalo-1 nuclear test

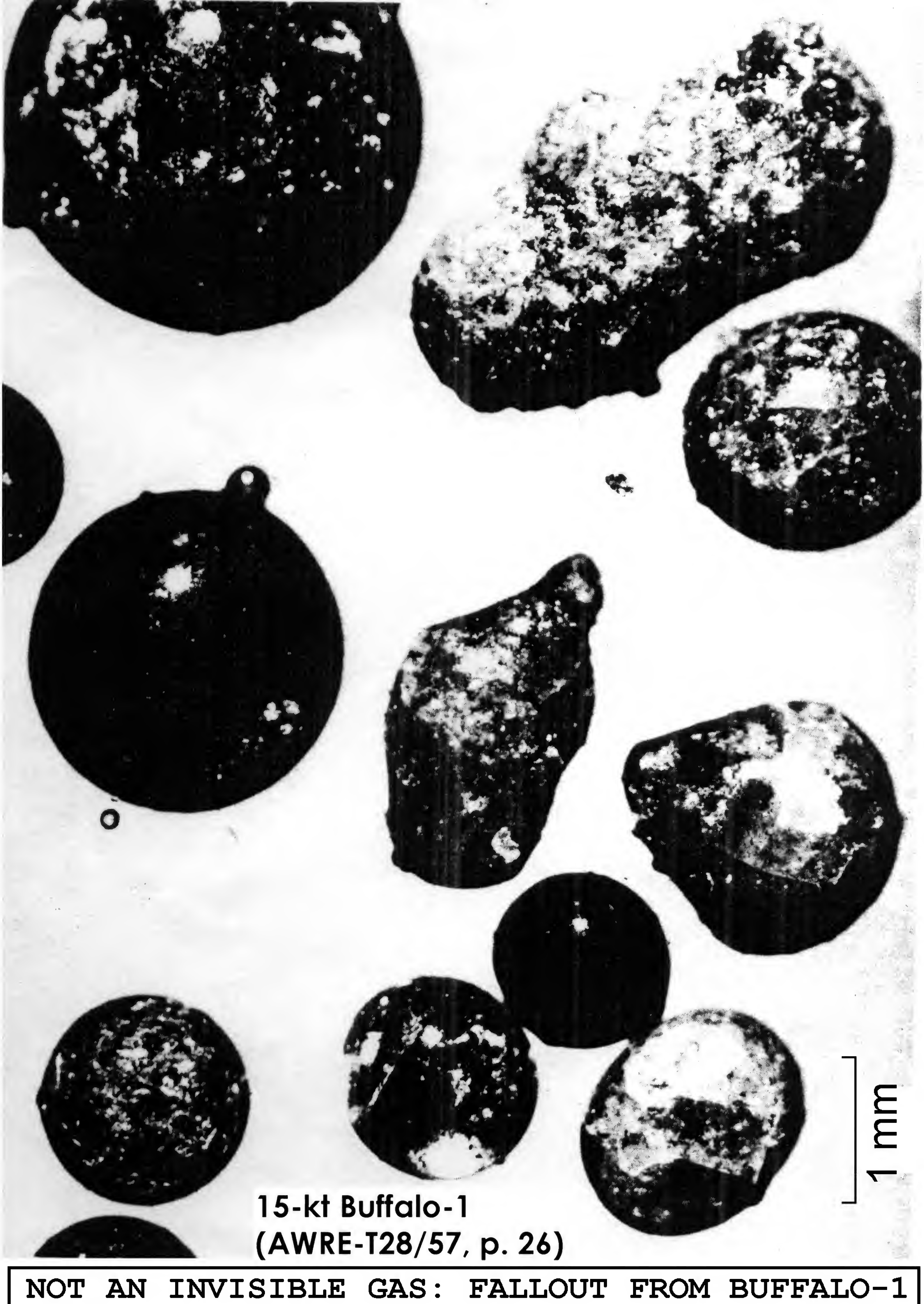
Blast precursor effect on car

Buffalo-1 at Maralinga, 1956. This nuclear test gave immense civil defence data.

Buffalo-1 vortex cloud forming as cooling fireball rises

Buffalo-1 nuclear test cloud reaching maximum altitude

Buffalo-1 nuclear test being dispersed by winds



NOT AN INVISIBLE GAS: FALLOUT FROM BUFFALO-1
Fallout from sandy soil was glassy marbles.

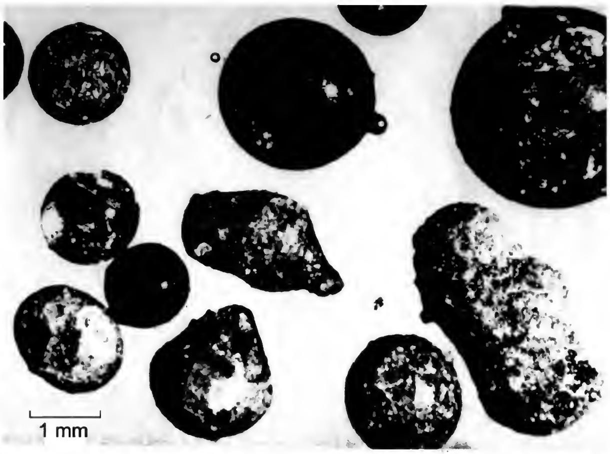
THE VISIBLE CONTAMINANT: SEEING FALLOUT

'Perhaps the most important application of radiological warfare would be its psychological effect as a mystery weapon, analogous to the initial use of poison gas and of tanks in World War I. The obvious method to combat radiological warfare in this case is to understand and be prepared for it.' – Dr Samuel Glasstone, Editor, *The Effects of Atomic Weapons,* Los Alamos Scientific Laboratory, September 1950, p. 289.

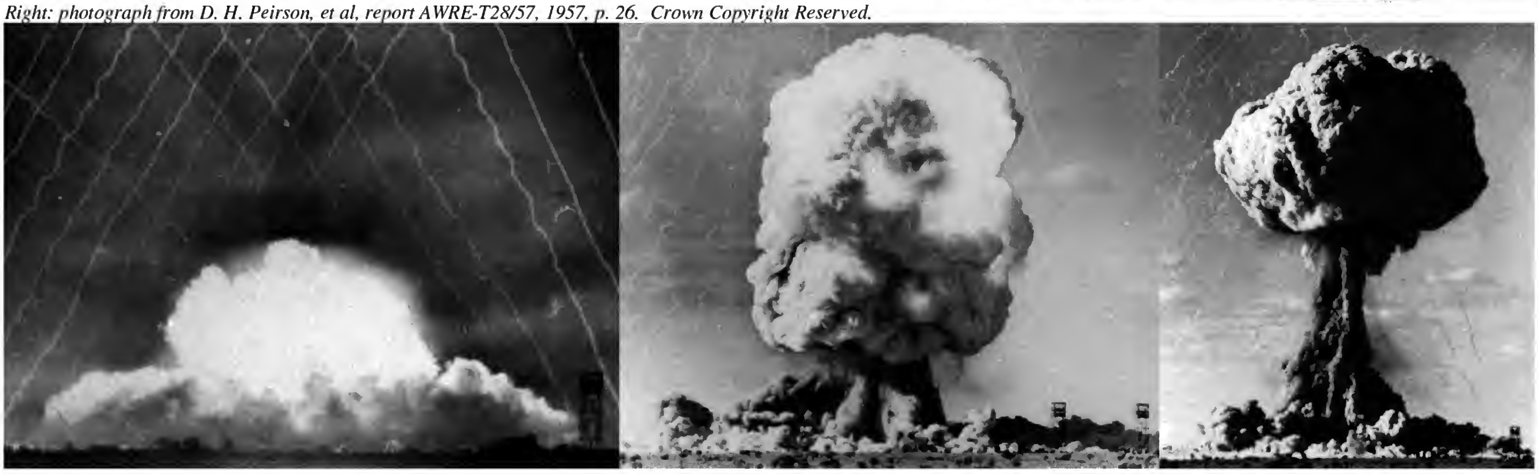
'Sampling stations were located ... aboard anchored barges, type YFNB, and manned ships ... Particles collected in the incremental type of collector were used ... particles could be classified by time of arrival. One of the ship sampling stations was connected by an elevator device to a radiation-shielded laboratory, permitting almost immediate examination of fallout samples.' – N.H. Farlow and W.R. Schell, U.S. Naval Radiological Defense Laboratory, technical report USNRDL-TR-170, 1957, p. 1.

Right: according to the popular superstition, you cannot *see, smell, hear*, or *feel* dangerous fallout, which is an invisible, mysterious, supernatural, all-pervading, fearful, death-ray weapon. This fiction came from two types of anti-nuclear propaganda: the first type confusing particles of radiation with particles of fallout, and the second type concerning the insignificantly radioactive (compared to background radiation), distant fallout from nuclear testing in the 1950s. The fact that data on the dangerous close in fallout was classified 'secret' did not help. The clearly visible nature of dangerous local fallout from the 15 kt Australian-British *Buffalo – One Tree* nuclear test (detonated on a 30.5 m high aluminium tower at Maralinga in Australia on 27 September 1956) is shown on the right. You can see this fallout forming in the fireball vortex photographs below.

The fallout consists of a mixture of large, smooth, globular, glossy, spherical particles resulting from the solidification of melted silicate sand with molten aluminium oxide from the tower, and a variety of unmelted, irregular sand grains. You can *hear* this dangerous fallout hitting surfaces and bouncing. You can also *see, touch,* and *feel* the particles where there is an acute threat to life, but you will not smell them (because of gravity, the fallout particles do not tend to enter your nose!). The melted particles are contaminated with insoluble activity trapped throughout their fused volume. Contamination on unmelted particles is limited to the surface, but is relatively soluble.

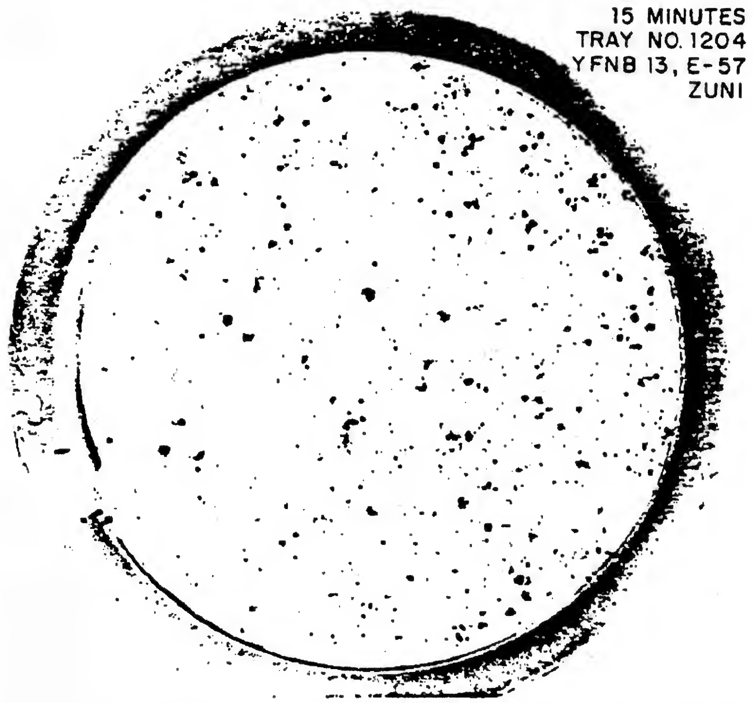


Right: photograph from D. H. Peirson, et al, report AWRE-T28/57, 1957, p. 26. Crown Copyright Reserved.

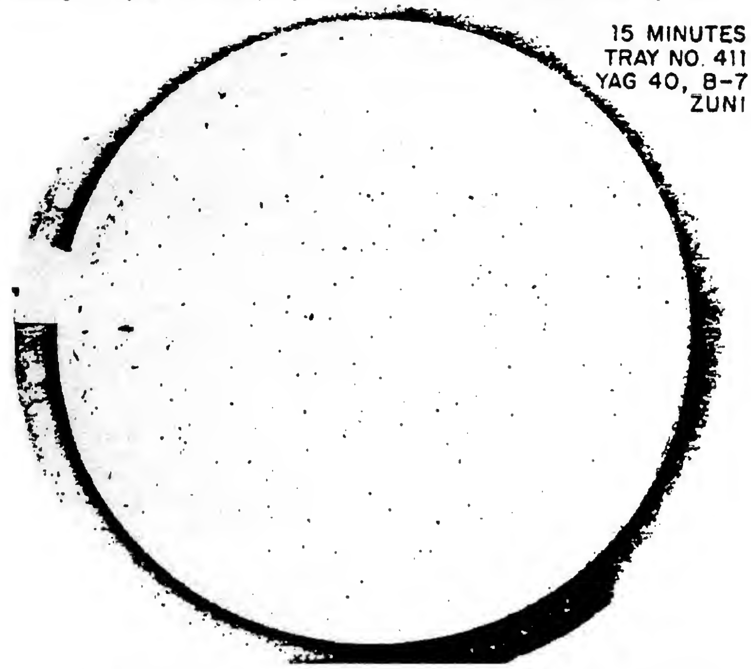


Above: fallout creation at 1, 8, and 20 seconds after detonation of the Australian-British 15 kt burst on a tower 30.5 m high, *Buffalo – One Tree,* at Maralinga, 27 September 1956. The turbulent mixing of sand and gas in the vortex fireball are clearly visible in the dry atmosphere, forming the mixture of fallout particles seen in the photograph above. The background grid of smoke trails seen at 1 second was laid down well behind the fireball by rockets fired about 8 seconds before detonation, specifically to make the shock front visible in films. The shock makes smoke trails appear to 'break' (just an illusion caused by the optical refraction of light in the compressed air of the shock front).

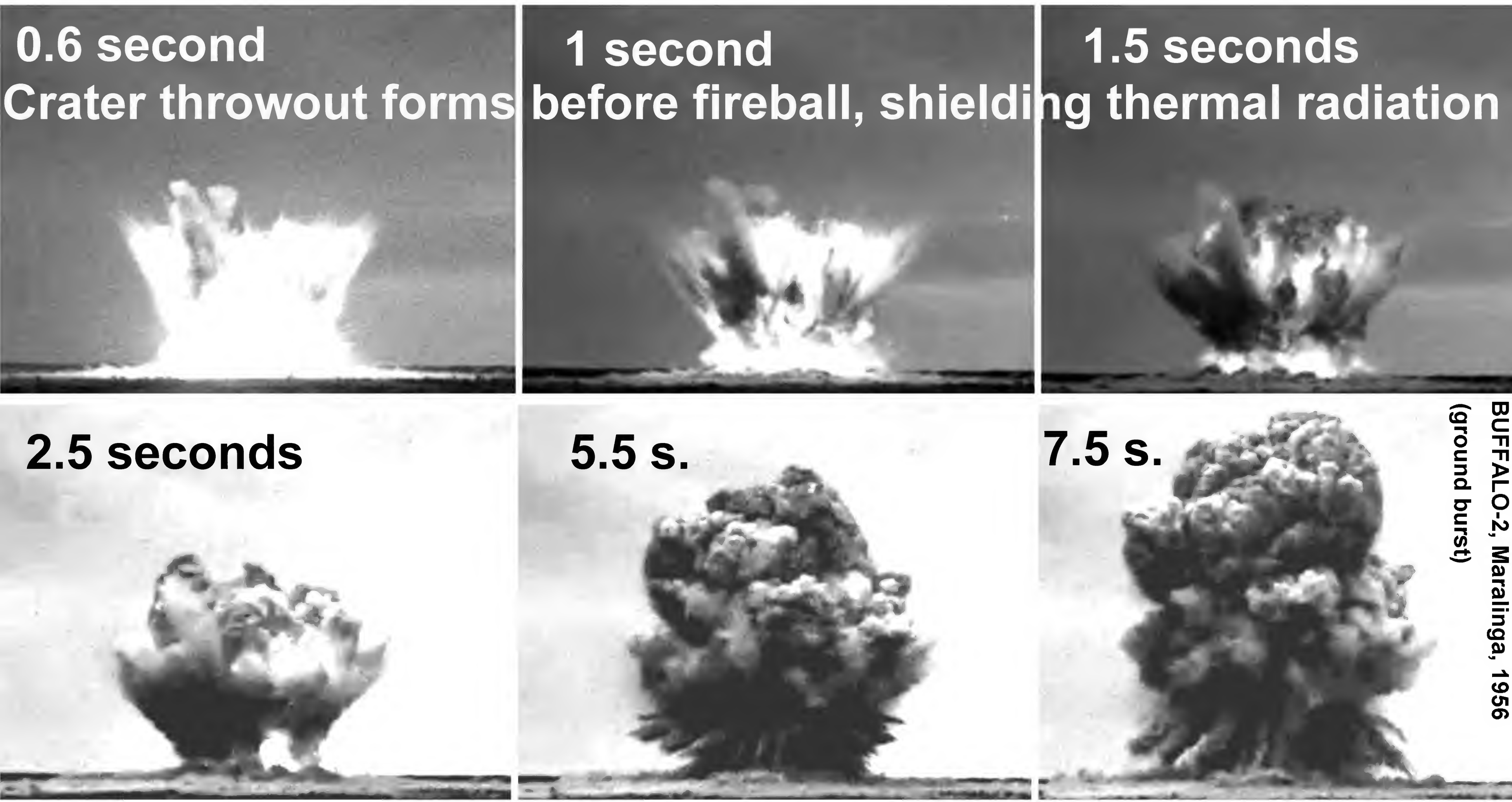
Below and left: *T. Triffet & P. D. LaRiviere, 'Characterization of Fallout,' U.S. Naval Radiological Defense Laboratory, report WT-1317, 1961, Secret-Restricted Data, p. 144.*



Seen and felt: 1956 secret photo of a fallout tray automatically exposed for just 15 minutes at 1 hour after detonation of the 3.53 Mt surface burst *Zuni*. Fallout on barge YFNB 13, at 20 km North-North-West of ground zero (downwind). The tray's inner diameter is 8.1 cm. This sample is only 22% of the total deposit of 21.9 g/m^2 at that location. The barge's radiation meter recorded a peak gamma intensity of 6 R/hr at 1.25 hours.

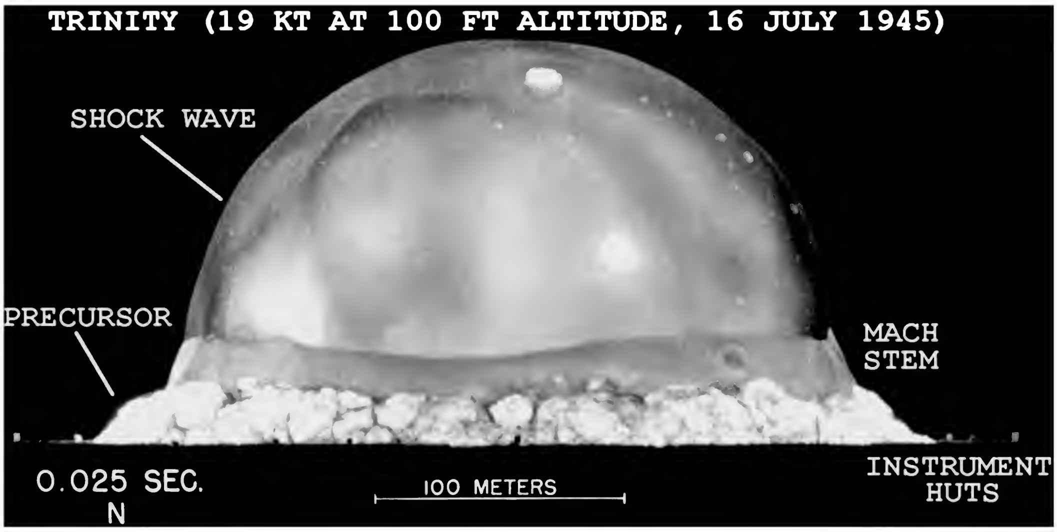


Seen and felt: 1956 secret photo of a fallout tray automatically exposed for just 15 minutes at 6 hours after detonation of the 3.53 Mt surface burst *Zuni.* Fallout on ship YAG 40, at 97 km North of ground zero (downwind). The tray's inner diameter is 8.1 cm. This sample is only 12% of the total deposit of 14.1 g/m^2 at that location. The ship's radiation meter recorded a peak gamma intensity of 7.6 R/hr at 6.7 hours.



BUFFALO-2, Maralinga, 1956 (ground burst)

Afterwinds immediately suck in base surge dust from throwout


TRINITY (19 KT AT 100 FT ALTITUDE, 16 JULY 1945)
SHOCK WAVE
PRECURSOR
MACH
STEM
INSTRUMENT
HUTS
0.025 SEC.
N
100 METERS


PRECURSOR DUST CLOUD ABSORBS FIREBALL BASE HEAT FLASH
1.0 SEC.
N
100 METERS


TOWER BASE, 1.4 R/HOUR
11 SEPTEMBER 1945

BROOKHAVEN NATIONAL LABORATORY BNL 917 (C-43)

ECOLOGICAL EFFECTS OF NUCLEAR WAR

*Proceedings of a Symposium**
Sponsored by

THE ECOLOGICAL SOCIETY OF AMERICA

at the
Thirteenth Meeting of

THE AMERICAN INSTITUTE OF BIOLOGICAL SCIENCES

Amherst, Massachusetts

August 1963

Physical Damage From Nuclear Explosions

CARL F. MILLER
Stanford Research Institute, Menlo Park, California

(pages 1-10)

Table 2

Survival Rates at Hiroshima and Nagasaki

Exposure	Condition	% Survival
50-100 cal/cm^2	Outside	0
	Indoors or shielded	90-100
4-6 psi	Outside	0
	In frame building	85-90
	In concrete building	95-100
	In underground shelter	100

The large particles contributing to local fallout consist mainly of fused and sintered grains of soil minerals. Fused particles are spherical, glassy beads and are usually the most highly radioactive. While in a fluid state in the fireball, these particles incorporate a large fraction of the least volatile fission products into a glassy matrix where such fission products are fixed. As the particles cool in the fireball and become viscous, the more volatile fission products (or their daughter products) collect on their surfaces. In this way, the larger of the fallout particles, those first ejected from the fireball, have radionuclide compositions enriched with the least volatile fission products, i.e., volatile element concentration is lowest. The smaller fallout particles, which remain in the rising cloud the longest, have radionuclide compositions enriched in the volatile elements.

Table 3

Contamination Factor, a_L,* for Crops

Romney, E.M., Lindberg, R.G., Hawthorne, H.A., Bystrom, B.G., and Larson, K.H. 1963. Contamination of plant foliage with radioactive fallout. *Ecology* **44**, 343-9.

Distance from ground zero, miles	Red clover	Alfalfa	Wheat	Mixed grasses
		Apple II Shot (Tower)		
7	5.6×10^{-5} (0.0011)**	–	5.3×10^{-5} (0.0020)	–
48	4.2×10^{-4} (0.0066)	–	6.0×10^{-4} (0.0240)	–
106	8.3×10^{-4} (0.0120)	–	18.0×10^{-4} (0.0580)	–
		Smoky Shot (Tower)		
132	–	2.6×10^{-3} (0.0490)	–	–
259	–	4.2×10^{-3} (0.1170)	–	3.2×10^{-3} (0.0530)

$$*a_L = \frac{\text{gross activity collected per g dry weight of foliage}}{\text{gross activity collected per sq ft of soil area}} = \frac{\text{sq ft of soil area}}{\text{g dry foliage}}.$$

**Values in parentheses are the fractions retained; they are equal to $a_L w_L$ where w_L is the foliage surface density in grams of dry foliage per sq ft of soil area.

Table 4

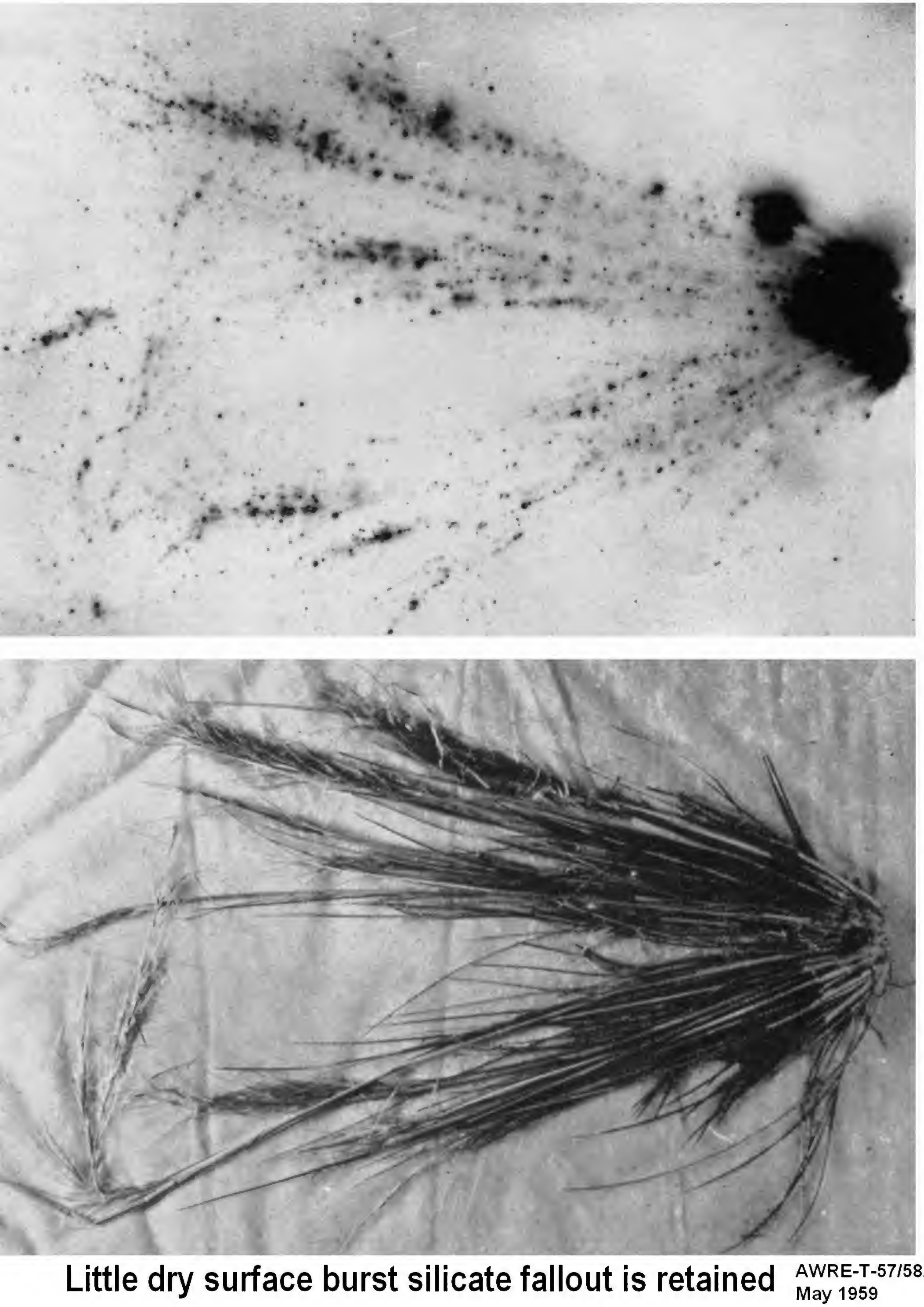
Russell, R.S. and Possingham, J.V. 1961. Physical characteristics of fallout and its retention on herbage. In *Progress in Nuclear Energy.* Series VI, Biological Sciences, Vol. 3, J.C. Bugher et al., Editors. Pergamon Press, New York. Pp. 2-26. **(AWRE-T-57/58, May 1959.)**

Summary of a_L Values Obtained at Operation Buffalo for Contamination of Rye Grass

Approximate I(max) range, r/h at 1 hr	a_L(av), $\frac{\text{sq ft of soil area}}{\text{g foliage}}$	$a_L w_L$*
0.07–0.15	6.8	0.15
0.15–0.30	7.1	0.16
0.30–0.60	5.9	0.13
0.60–1.00	2.7	0.06
1.00–2.00	4.0	0.09
2.00–5.00	2.9	0.07
5.00–9.00	1.4	0.03

*Where $w_L = 22.3$ g foliage/sq ft of soil area (height of grass $= 0.33$ ft).

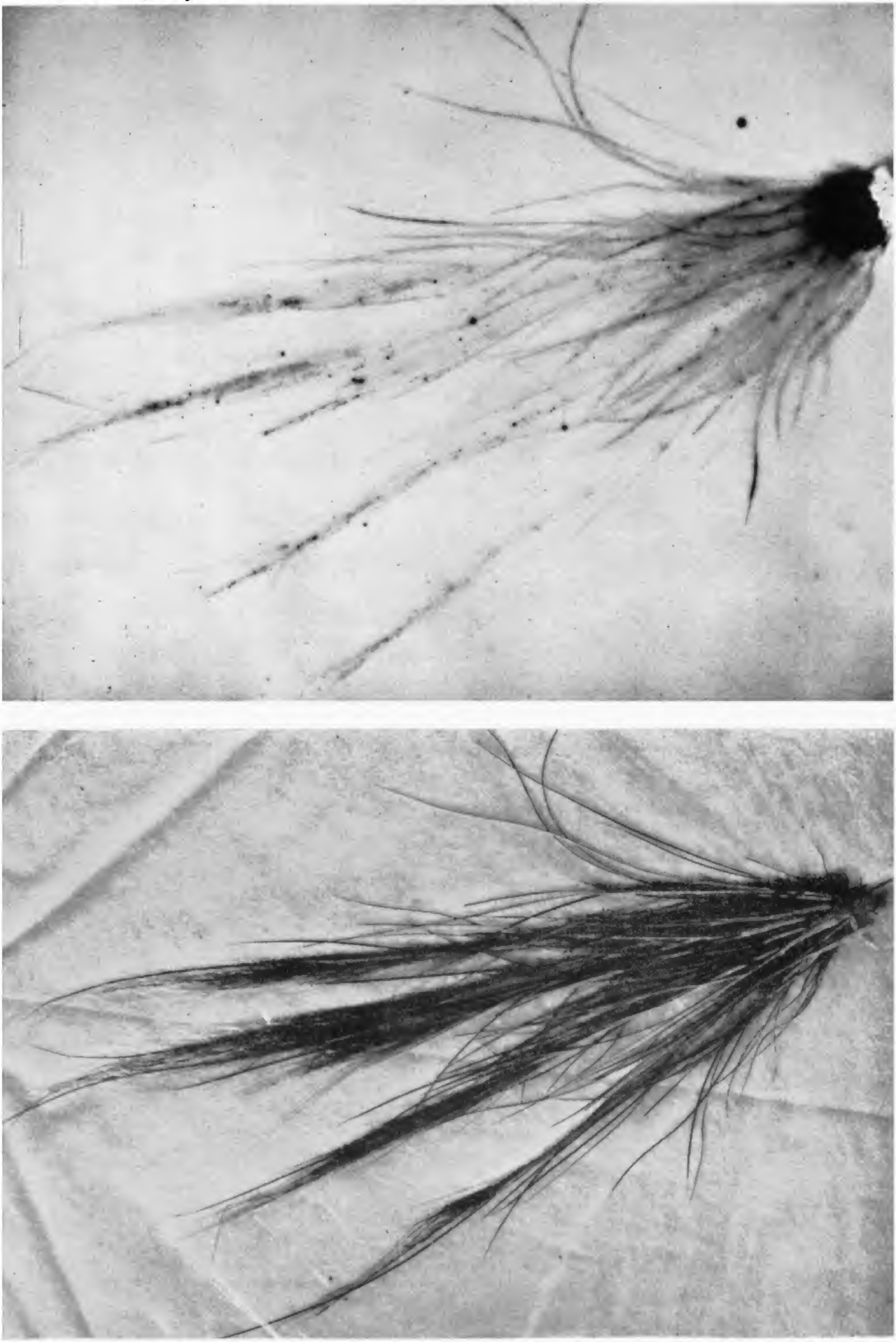
Ryegrass (Lolium perenne) after 15 kt Buffalo-1 tower shot at Maralinga



Little dry surface burst silicate fallout is retained

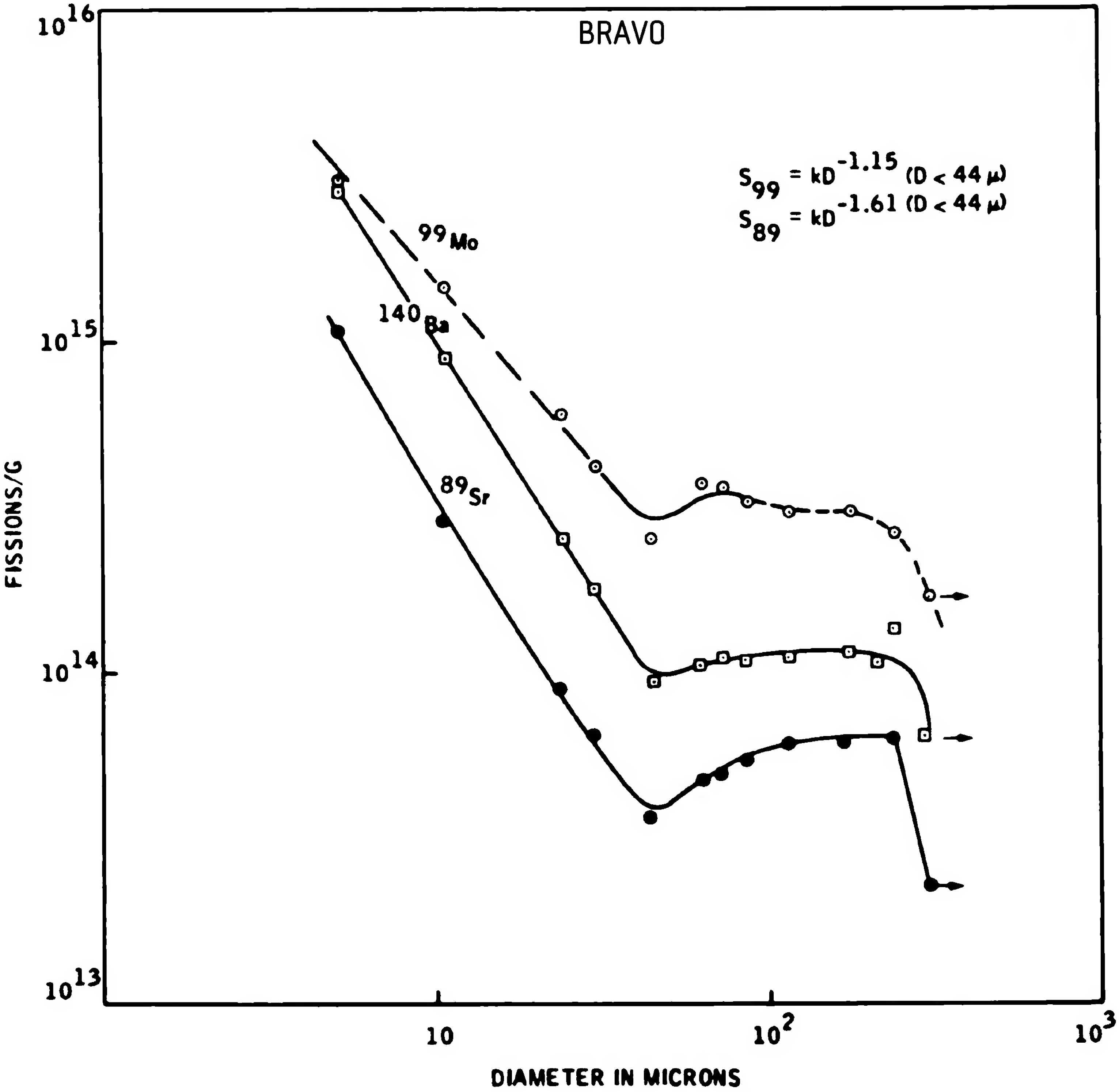
AWRE-T-57/58, May 1959

AWRE-T-57/58, May 1959



Ryegrass (Lolium perenne) after 1.5 kt Buffalo-2 surface shot at Maralinga, after 2 cm rain

Morgenthau, M., H. E. Show, R. C. Tompkins, and P. W. Krey.
1960. Land fallout studies. Defense Atomic Support Agency Rep.
WT-1319. Washington, D.C.



Specific activity of fallout as function of particle diameter

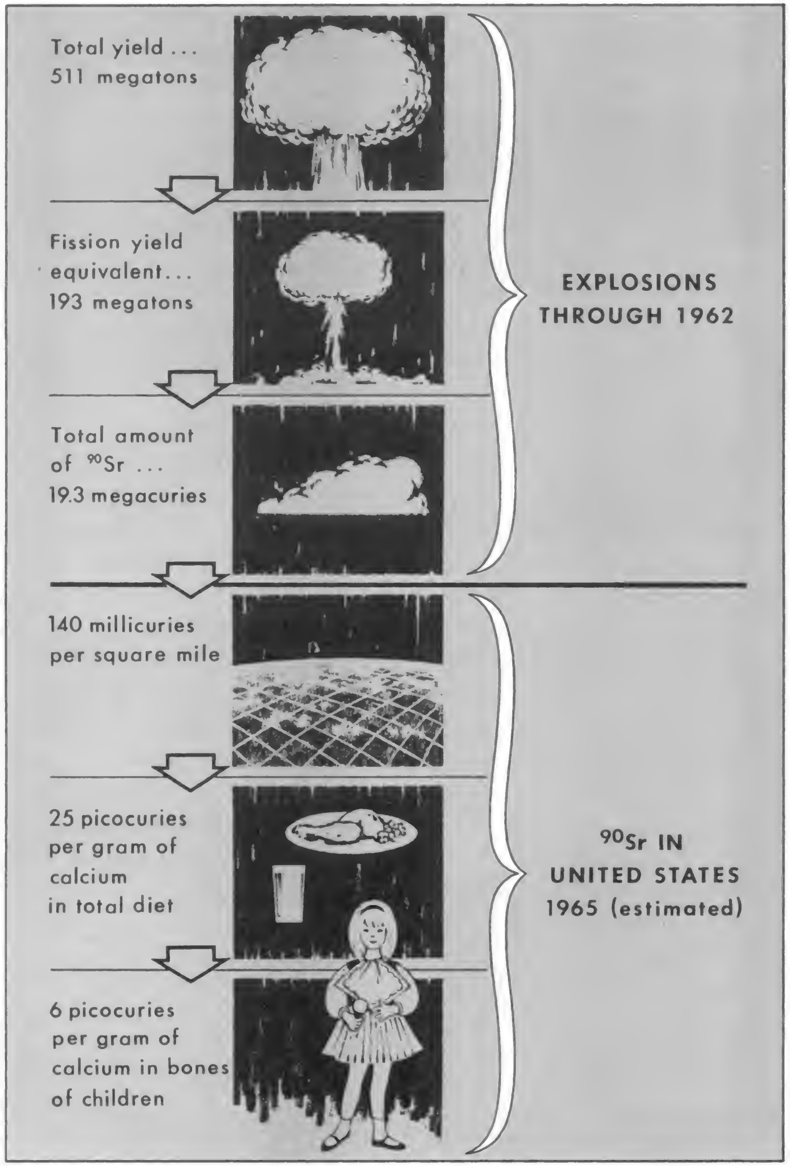
(Equivalent fissions $\times 10^{-14}$ per gram)

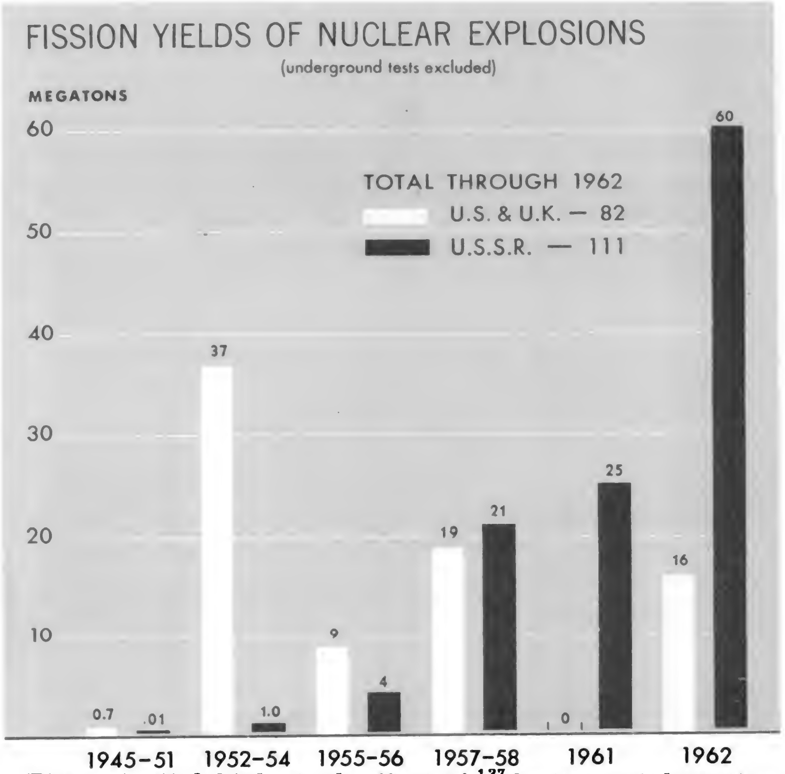
$D_g(\mu)$	ZUNI 3.5 Mt (Prompt Fallout near Ground Zero)	ZUNI 3.5 Mt (Fallout Collected 80 km Downwind)	TEWA near ground zero 5.1 Mt	15 Mt BRAVO (Radioactive Particles Only, Shot Atoll, Spheres plus Irregulars)	LACROSSE 0.04 Mt (All Particles, Shot Atoll, Spheres plus Irregulars)
Chain 99 (^{99}Mo)					
57	4.8	16.0	10.2	7.2	2.5
88	4.9	10.6	8.9	6.6	4.0
125	5.8	9.8	8.4	6.2	4.7
177	6.0	12.5		6.0	5.7
297	12.4	13.2		4.8	4.5
594	11.9	21.3		3.4	1.6
840	3.1	24.3		–	–
Chain 89 (^{89}Sr)					
57	0.075	0.24	0.36	0.086	0.063
88	0.065	0.17	0.28	0.11	0.074
125	0.046	0.19	0.24	0.12	0.082
177	0.042	0.14		0.12	0.062
297	0.043	0.12		0.13	0.044
594	0.044	0.11		0.046	0.063
840	0.075	0.070		–	–
Chain 140 (^{140}Ba)					
57	0.32	1.28	0.67	0.20	0.25
88	0.27	0.74	0.54	0.22	0.28
125	0.20	0.99	0.45	0.22	0.30
177	0.17	0.77		0.23	0.23
297	0.15	0.75		0.25	0.18
594	0.16	0.67		0.13	0.24
840	0.031	0.41		–	–

Morgenthau, M., H. E. Show, R. C. Tompkins, and P. W. Krey. 1960. Land fallout studies. Defense Atomic Support Agency Rep. WT-1319. Washington, D.C.

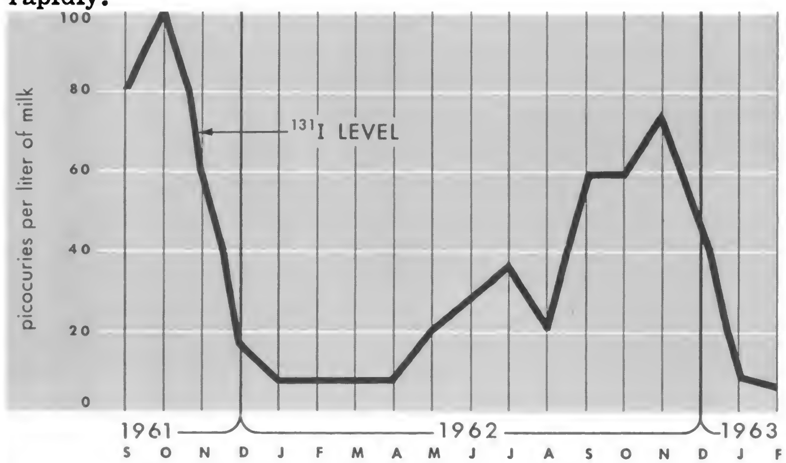
Fall out from nuclear tests, by C. L. Comar (U.S. Atomic Energy Commission, Understanding the Atom series, revised edition, 1966)

PAST EXPLOSIONS AND STRONTIUM-90 LEVELS





The potential biological effect of ^{137}Cs is much less than that of ^{90}Sr because ^{137}Cs is removed from the body more rapidly.



Remedial measures for ^{131}I are relatively simple because of its short half-life, and because it reaches the public primarily in a single identifiable food, milk.

Measures proposed to be put into effect should ^{131}I in milk reach stipulated levels are:

(a) *Use of stored feed instead of pasture for dairy cows.*

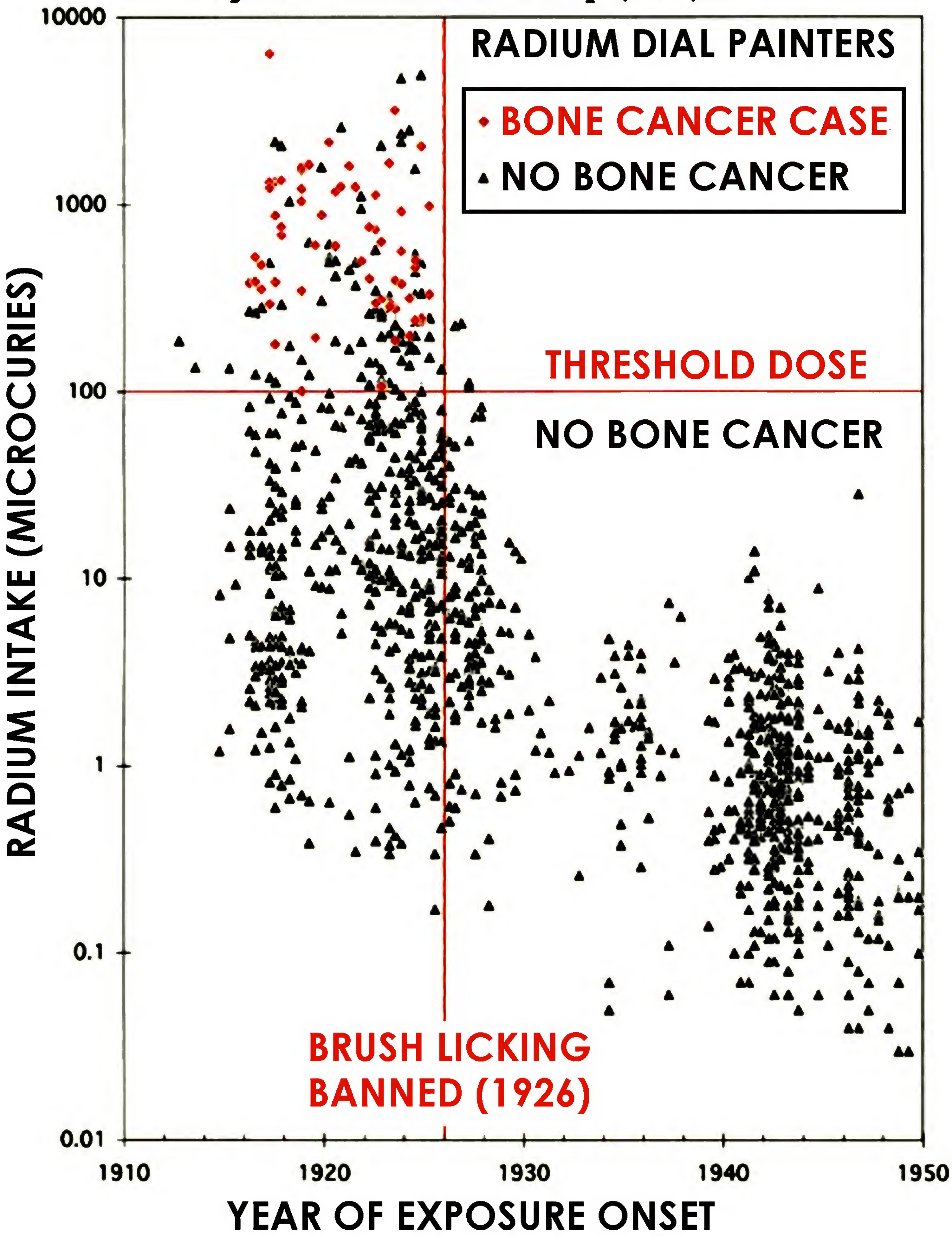
(b) *Use of evaporated or powdered milk for young children and pregnant and lactating women.*

(c) *Use of stored milk products.*

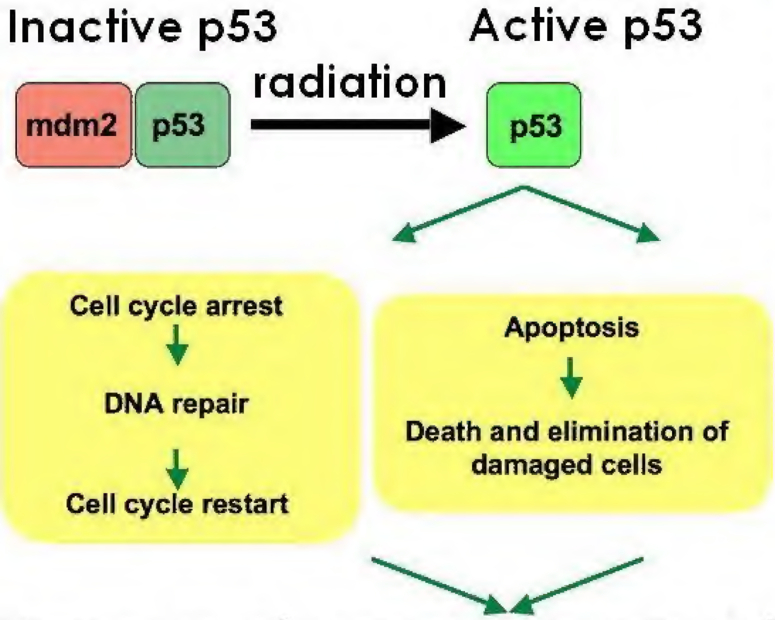
Addition of stable iodine to human diet.

Cyril L. Comar is professor of physical biology at Cornell University and has acted as consultant and advisor to many national and international committees

Rowland, R. E. Radium in Humans: A Review of U. S. Studies, Argonne National Laboratory (1994).



Dr C. Sanders, Radiation Hormesis and the LNT Assumption, Springer, 2010



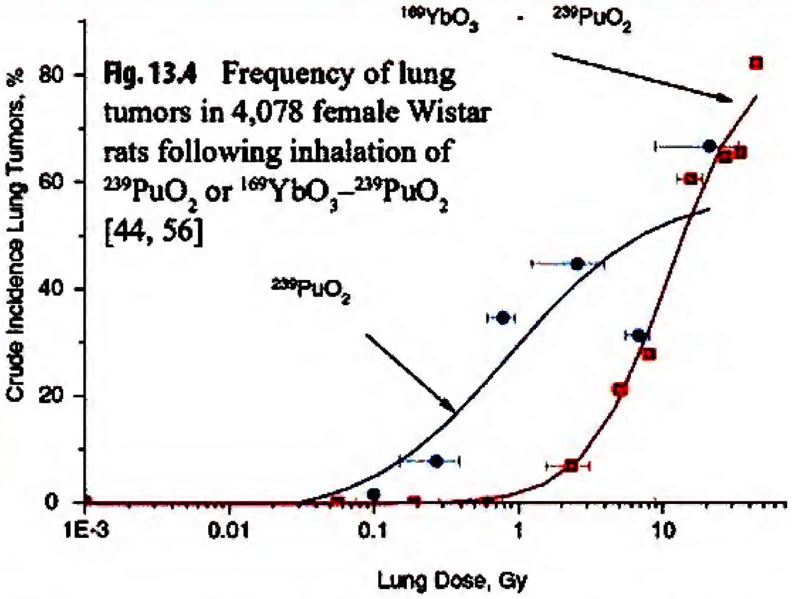
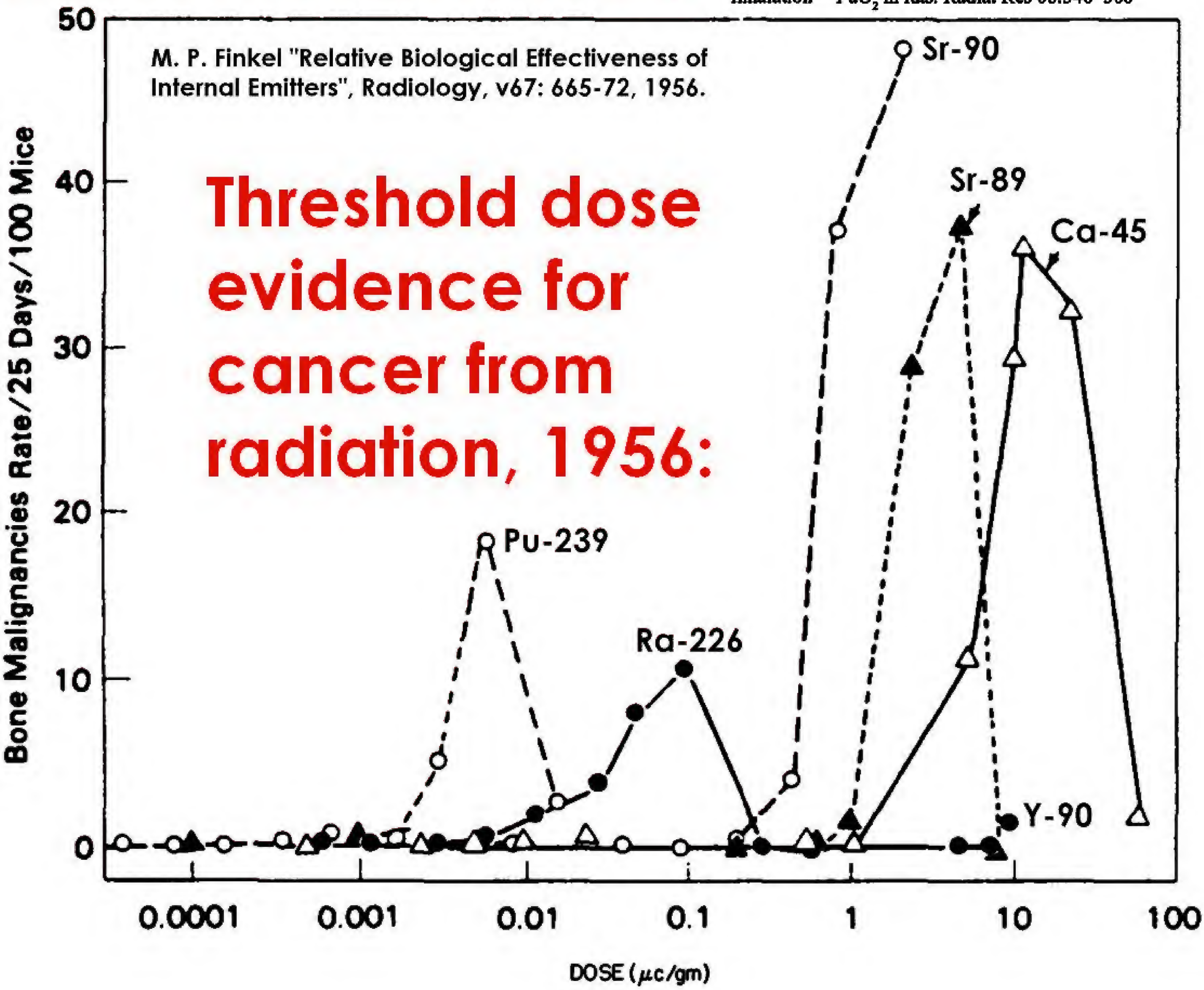


Fig. 13.4 Frequency of lung tumors in 4,078 female Wistar rats following inhalation of $^{239}PuO_2$ or $^{169}YbO_3$–$^{239}PuO_2$ [44, 56]

Prevention of cancer or genetic defect at low dose rates (at high dose rates, double strand DNA breaks are too rapid)

44. Sanders CL, Lauhala KE, McDonald KE (1993) Lifespan studies in rats exposed to $^{239}PuO_2$ aerosol. III. Survival and lung tumors. Int J Radiat Biol 64:417–340

56. Sanders CL, Dagle GE, Cannon WC et al (1976) Inhalation $^{239}PuO_2$ in rats. Radiat Res 68:340–360



Dose range milli-sievert	Number in 1950	Cancer deaths (excl. leukaemia)		Leukaemia deaths	
		total rate	rate from radiation	total rate	rate from radiation
Less than 100	68467	11.2%	0.09%	0.2%	0.01%
100 to 200	5949	12.3%	0.7%	0.2%	-0.01%
200 to 1000	9806	13.2%	1.9%	0.6%	0.3%
More than 1000	1829	24.1%	8.1%	3.5%	2.4%
All	**86611**	**11.7%**	**0.6%**	**0.3%**	**0.1%**

Cancer deaths among 86611 Hiroshima and Nagasaki survivors, 1950-2000

The total radiation-related deaths from solid cancer and leukaemia were 480 and 93, respectively.

Source: Dr Wade Allison
1 milliSievert = 100 mR

http://www.bioone.org/doi/abs/10.1667/RR3232

Preston, D. L., Pierce, D. A., Shimizu, Y., Cullings, H. M., Fujita, S., Funamoto, S. and Kodama, K., "Effect of Recent Changes in Atomic Bomb Survivor Dosimetry on Cancer Mortality Risk Estimates," Radiat. Res. v162, pp377–389 (2004).

1979 U.S. Office of Technology Assessment, "The Effects of Nuclear War" deceptions

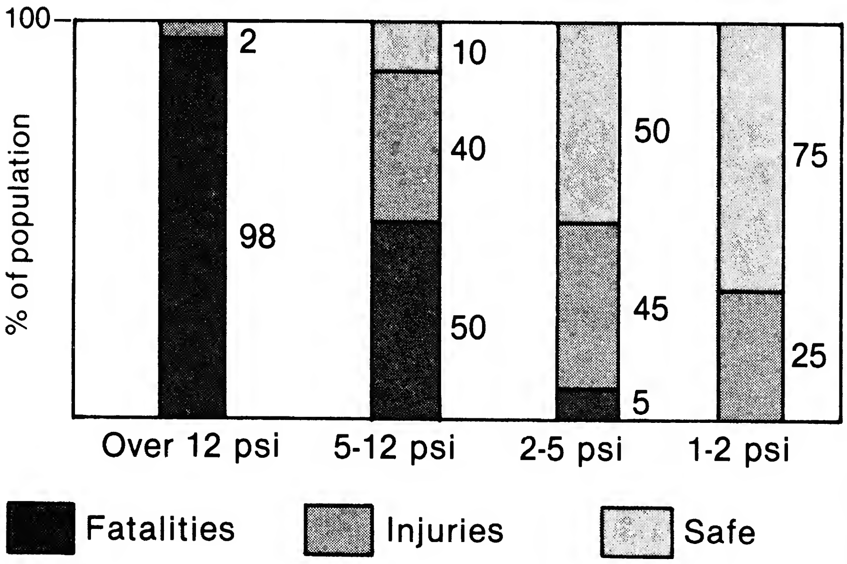
Table 14.—Long-Term Radiation Effects From Nuclear Attacks

Estimated worldwide[b] effects from 1-Mt air burst over a city (OTA Case 1):	
Somatic effects	
Cancer deaths	200 - 2,000
Thyroid cancers	about 700
Thyroid nodules	about 1,000
Genetic effects	
Abortions due to chromosomal damage	100 - 1,000
Other genetic effects	350 - 3,500

[b] Most worldwide fallout would be in the Northern Hemisphere

Above: false LNT radiation scaremongering

Figure 1.—Vulnerability of Population in Various Overpressure Zones



Damage to unreinforced brick house (5-psi overpressure)

Above: false house collapse (Apple-2 test house after manually demolished!) photo. In fact, outer walls exploded but 1st floor did not collapse at 5 psi, and outward debris motion reduced hazard!

Blast exaggeration:

Table 4.—Casualty Estimates (in thousands) (1 Mt on Detroit)

Region (mi)	Area (mi²)	Population	Fatalities	Injuries	Uninjured
0-1.7	9.1	70	70	0	0
1.7-2.7	13.8	250	130	100	20
2.7-4.7	46.5	400	20	180	200
4.7-7.4	102.6	600	0	150	450

Exaggerated blast effects table ignores modern city concrete buildings which resist blast collapse

Table 5.—Burn Casualty Estimates (1 Mt on Detroit)

Distance from blast (mi)	Survivors of blast effects	Fatalities (eventual)		Injuries	
		2-mile visibility	10-mile visibility	2-mile visibility	10-mile visibility
(1 percent of population exposed to line of sight from fireball)					
0-1.7	0	0	0	0	0
1.7-2.7	120,000	1,200	1,200	0	0
2.7-4.7	380,000	0	3,800	500	0
4.7-7.4	600,000	0	2,600	0	3,000
Total (rounded)		1,000	8,000	500	3,000
(25 percent of population exposed to line of sight from fireball)					
0-1.7	0	0	0	0	0
1.7-2.7	120,000	30,000	30,000	0	0
2.7-4.7	380,000	0	95,000	11,000	0
4.7-7.4	600,000	0	66,000	0	75,000
Total (rounded)		30,000	190,000	11,000	75,000

These calculations arbitrarily assume that exposure to more than 6.7 cal/cm² produces eventual death, and exposure to more than 3.4 cal/cm² produces a significant injury, requiring specialized medical treatment.

Exaggerated thermal burns table "arbitrarily" assumes 6.7 cal/cm^2 is lethal and 3.4 cal/cm^2 hospitalizes.

This was not true even for light clothing in Hiroshima and for bigger yields even more heat is needed! Skyline shadowing protects over 90%.

29 kt Teapot-Apple 2 test, 5 psi peak overpressure

exterior walls were exploded outward, so that very little masonry debris fell on the floor framing. The roof was demolished and blown off, the rear part landing 50 feet behind the house.

S. Glasstone, Effects of Nuclear Weapons, 1964, p208

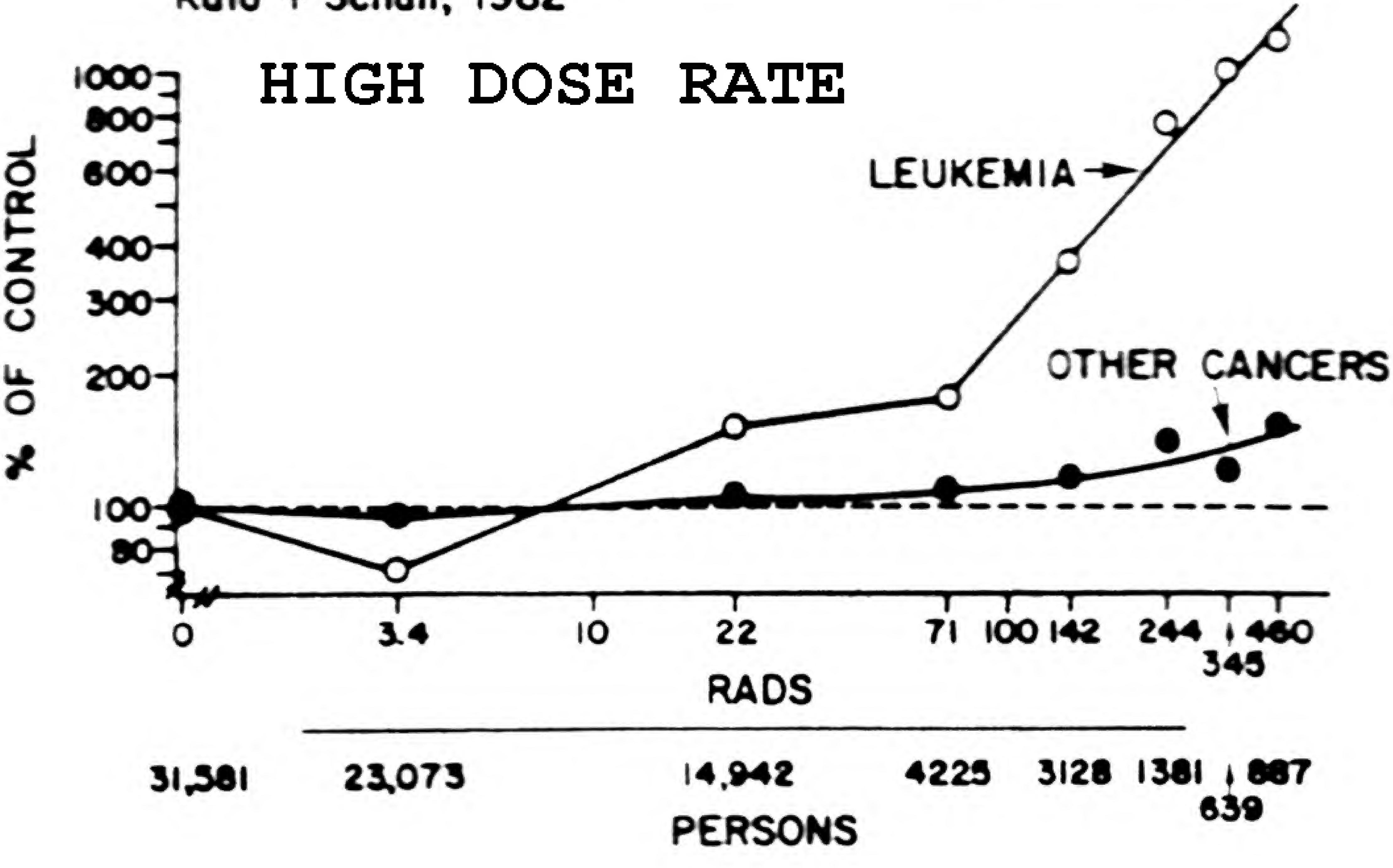
Wall brick debris was blown out, not in on to people!





Morrison shelter survives direct hit in York 1942

1950-78 CANCER MORTALITY IN HIROSHIMA-NAGASAKI
Kato + Schull, 1982



HOME OFFICE

CIVIL DEFENCE
TRAINING MEMORANDUM No. 4

The Clearance of Z Zones by Road

(*REVISED* 1965)

(Z Zones are fallout areas where the 48 hour gamma dose rate is above 10 R/hour. This corresponds to a dose rate of 1,000 R/hour or more at 1 hour after a nuclear explosion. The outside dose accumulated from an arrival time of 1 hour after a 1 megaton burst, up to evacuation at 48 hours, is:

$$\text{Dose} = 5 \times 1000 \times (1 - 48^{-0.2}) = 2{,}700 \text{ R outdoors}$$

or 67 R in a brick house's room with blocked windows)

LONDON
HER MAJESTY'S STATIONERY OFFICE
1965

SIXPENCE NET

The Clearance of Z Zones by Road

Introduction

1 This memorandum is concerned with the drill for clearance by road from those parts of a Z Zone which are not in a damaged area. In a damaged area the drill would have to be modified as necessary to meet the special conditions obtaining, e.g. restriction of road access. The memorandum deals only incidentally with the areas to which people will be cleared. It is assumed that 'assembly towns' of, say, from 8,000 to 50,000 population at distances up to about 20 miles from the Z Zone will be selected to receive those cleared; and that the bases from which clearance operations will be mounted will be on the outskirts of those assembly towns commanding main routes into the Z Zone. It may sometimes be desirable to site the clearance bases further forward; in which case staging points will be set up from which people will be transported to the assembly town by train or other means.

2 In clearance the maximum use must be made of all forms of petrol-driven transport, including public transport already within a Z Zone. Families capable of clearing themselves should do so; and wardens should, so far as possible, arrange in advance that spare places are reserved for neighbours. The opportunity should be taken wherever possible to provide for people living in remote areas without their own transport to be collected by private transport on the way out. This will simplify the task of clearance from outside. Instructions to the public will require that houses left completely empty should be marked by the last person to leave by hanging a sheet out of a front window.

3 The proportion of population capable of being moved by transport already in a Z Zone is likely to be substantial but the remainder will have to be cleared by transport sent in from outside.

4 The closest contact will have to be maintained at every level between the warden organisation within the Zone and the clearance forces working from outside. The wardens will be responsible for providing clearance forces with essential information; and, in anticipation of the area coming within a Z Zone, should make the preliminary plans described in Appendix I.

General principles of clearance

5 The physical clearance of a Z Zone would rarely start before H+48 hours although planning might be instituted at an earlier time. The wartime emergency dose of 75r will apply to all engaged. The object will be to clear the Zone as quickly as possible within the limits set by this dose and the size of the forces available.

6 Clearance by night or when visibility is bad, is likely to increase the time of exposure and should be avoided if possible. Delays caused by suspending clearance during the hours of darkness would make little difference to the total dose received by those in their fallout rooms in the Z Zone.

7 For clearance from outside, passenger carrying vehicles with a capacity of not less than 30 should be used. The use of vehicles of lesser capacity would be radiologically extravagant to clearance personnel, and should not be used unless there is no practical alternative.

8 Zones will be cleared inwards sector by sector or district by district. Throughout each sector or county district* council areas in turn self-clearance will be effected first and clearance organised from the outside will then be undertaken as far as possible simultaneously in every warden post and patrol area.

9 Clearance vehicles will operate in convoys of about five. In general one convoy will be allotted to each patrol area. To avoid unnecessary exposure to radiation of their occupants, vehicles should be sent individually to assembly towns as soon as they are loaded unless there is some good reason for acting otherwise. After unloading they will be reformed into convoys at the clearance base.

10 In built-up areas convoys will on their initial trip be directed to the warden posts and from there to the patrol areas they are to clear. In rural areas this method of routing would be radiologically expensive and should be unnecessary. Where the position of a patrol post can be easily indicated on a 1″ map the rule will be for the convoy to go direct to the patrol post in rural areas.

Allotment of responsibilities

11 Overall responsibility for deciding when a Z Zone is to be cleared and where the population of the Zone is to be moved will rest with the Regional Seat of Government which will allot responsibilities to individual Sub-regional headquarters. Responsibility for clearing segments of a Z Zone, and the transport for that purpose will be alloted by Sub-regional headquarters to county or county borough controls. Responsibility for receiving the people cleared will be apportioned to the county or county borough controls within whose boundaries the assembly towns lie. Where responsibilities are separated co-ordination will be maintained by the next higher control, e.g. co-ordination between county or county borough controls by Sub-regional headquarters.

12 A single Z Zone may well extend into two or more Regions and a single Region contain parts of two or more separate Zones. Each Zone will have been given a code name. For clearance purposes segments will be known as Regional, Sub-regional, county, and in some cases county sub, or county borough segments as the case may be, and will be further identified by the appropriate numbers and letters of the responsible control, e.g. county segment (or simply segment) 62A.

---

* NOTE: All later references to 'district' refer to 'county district council areas'.

13 Operations will be conducted by clearance units, set up by the responsible control, which will appoint the commanders, establish the bases and give each unit a segment, to be known as a clearance segment, to deal with. The boundaries of clearance segments should so far as is possible follow those of warden sectors or districts if sectors do not exist. Clearance unit comanders will normally be civil defence assistant controllers (Ops) or mobile controllers, unless the unit is provided by the military or by a police mobile column. Within a county or county borough all units, under whatever command, will be lettered in sequence and the same lettering will be used to identify the clearance segments, e.g. (clearance) segment 62AA.

14 A clearance unit should have about 125 buses or coaches, with an average lifting capacity of, say, 5,000 people. One hundred and fifty vehicles (average lifting capacity 6,000) should be regarded as the maximum. The number of lifts that can be accomplished in a day will depend on the time of year, whether the population of the segment is concentrated or scattered, and the length of run to the assembly town or staging point; but it may be expected to vary from about two to four. County or county borough control must judge from these factors the number of units required and the size of the clearance segments to be allotted to each. During the progress of operations there may well be need to adjust either the boundaries of the segments or the strength of the units.

15 It may be necessary for a clearance unit to call in the ambulance resources of counties or county boroughs in order to clear people whose physical condition makes it impossible to transport them by bus or coach. For radiological reasons the use of ambulances must be kept to an absolute minimum. If there should be an acute hospital, containing a large number of patients, in the Z Zone, special arrangements for their clearance and reception would have to be made at county or county borough level or above.

The clearance unit

16 In order that a clearance unit, when clearing each sector or district in its turn, should be able to work simultaneously in every warden post and patrol area within that sector or district it should have an operational staff approximating to the following "standard".

Clearance unit commander (1): to be responsible for organising the clearance of the sector or district generally.

Clearance officers (5): each responsible for organising the clearance of a warden post area and taking charge of a section of five convoys.

Convoy commanders (25): each in charge of a convoy of five buses or coaches operating in a given patrol area.

Drivers and mates will be needed for the 125 buses and/or coaches and drivers for the six cars with which the unit will be provided. Relief bus drivers should be sought as required, if necessary with the help of local Ministry of Labour representatives.

Signal staff and equipment for maintaining communications with the static control, should telephones not be working, and office staff for a mobile control plus six messengers, would also be required.

17 Of the above, the convoy commanders, bus drivers and mates whose duties will take them constantly in and out of the Z Zone, will have to be replaced as and when their wartime emergency doses are expended—perhaps after seven or eight lifts over two or four days. Clearance officers and car drivers and messengers will also enter the Z Zone, but less frequently and for shorter periods; so that in their case replacement should not be necessary for a long time, if at all.
(For administrative staff at base see paragraph 22).

18 This "standard" unit may be varied as required by increasing or reducing the number of buses or coaches and so the size or number of convoys or convoy sections with consequent alterations in the number of convoy commanders or clearance officers. Considerations of administration and maintenance will, however, require an upper limit of 150 vehicles.

19 Whatever unit is employed there will almost certainly be need to make constant readjustment between the various parts during the course of operations; according, for instance, to the number of warden post and patrol areas within whichever sector is being cleared, their populations, and the particular difficulties they present.

20 The designations used in paragraph 13 are entirely functional. Except where a clearance unit is provided by a military formation or a police mobile column its operational staff may be drawn from a variety of sources. (See Appendix III.) It is of great importance that the right people should be found to act as convoy commanders, since these will have the major responsibility for dealing with the public in the Z Zone, and (as will be evident from paragraph 32) the task is one requiring an ability to inspire confidence and the highest qualities of firmness and tact. The work might be undertaken by post or deputy post wardens from areas unaffected by fallout; but it is one for which police officers would be particularly well suited.

The clearance base

21 The essential facilities required for a clearance base are:

(a) Good communications.

(b) Access to adequate P.O.L. supplies.

(c) Hardstanding for the vehicles.

(d) Accommodation for personnel.

(e) Feeding facilities (these might be provided in billets or by Welfare Section emergency feeding teams).

It should be possible for the facilities to be found on the outskirts of most towns. A large bus depot would be ideal.

HOME OFFICE

CIVIL DEFENCE
TRAINING MEMORANDUM No. 6

The Evacuation of Casualties

(*PROVISIONAL*)

LONDON
HER MAJESTY'S STATIONERY OFFICE
1961

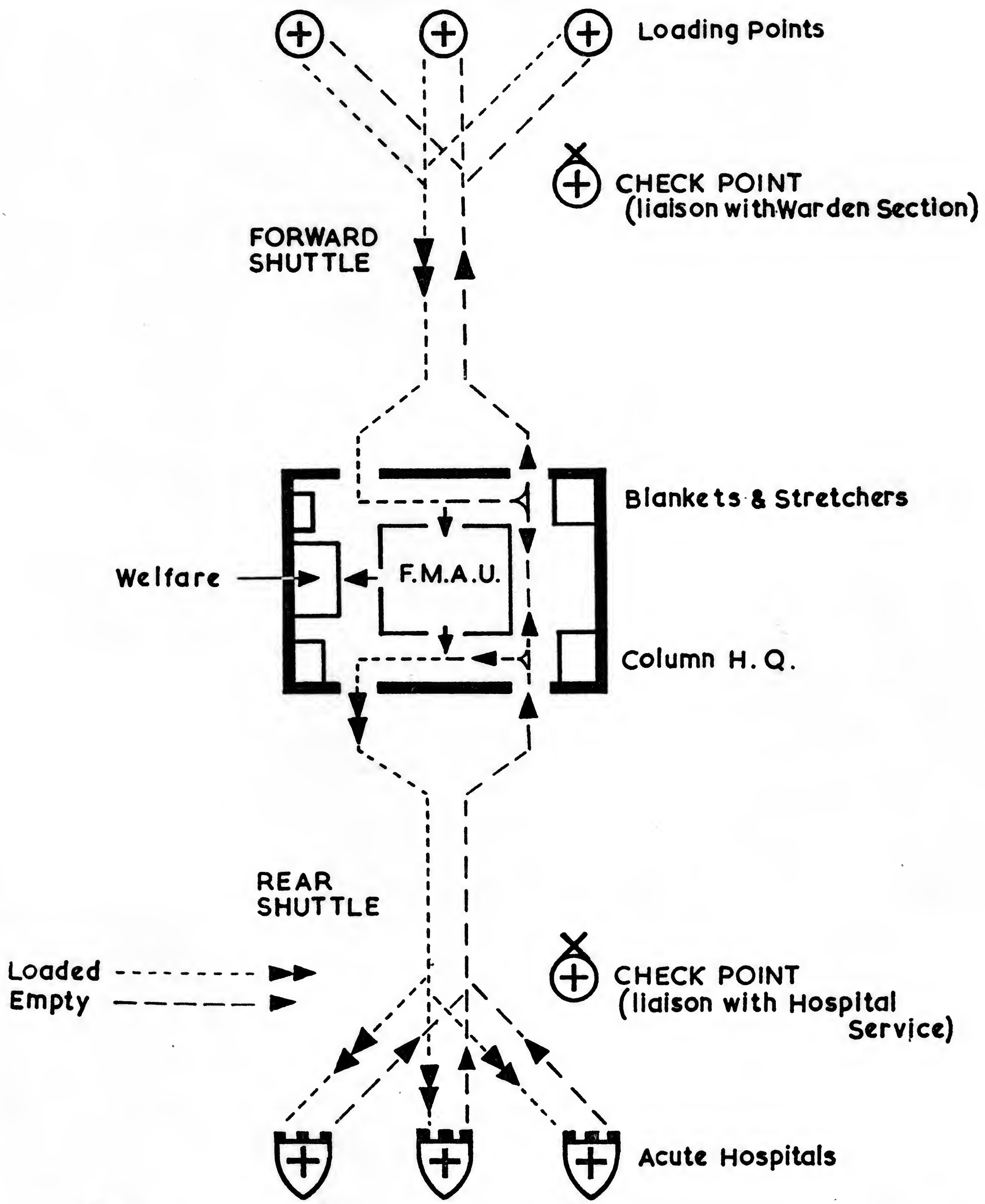
EIGHTPENCE NET

THE ORGANISATION OF AN AMBULANCE COLUMN

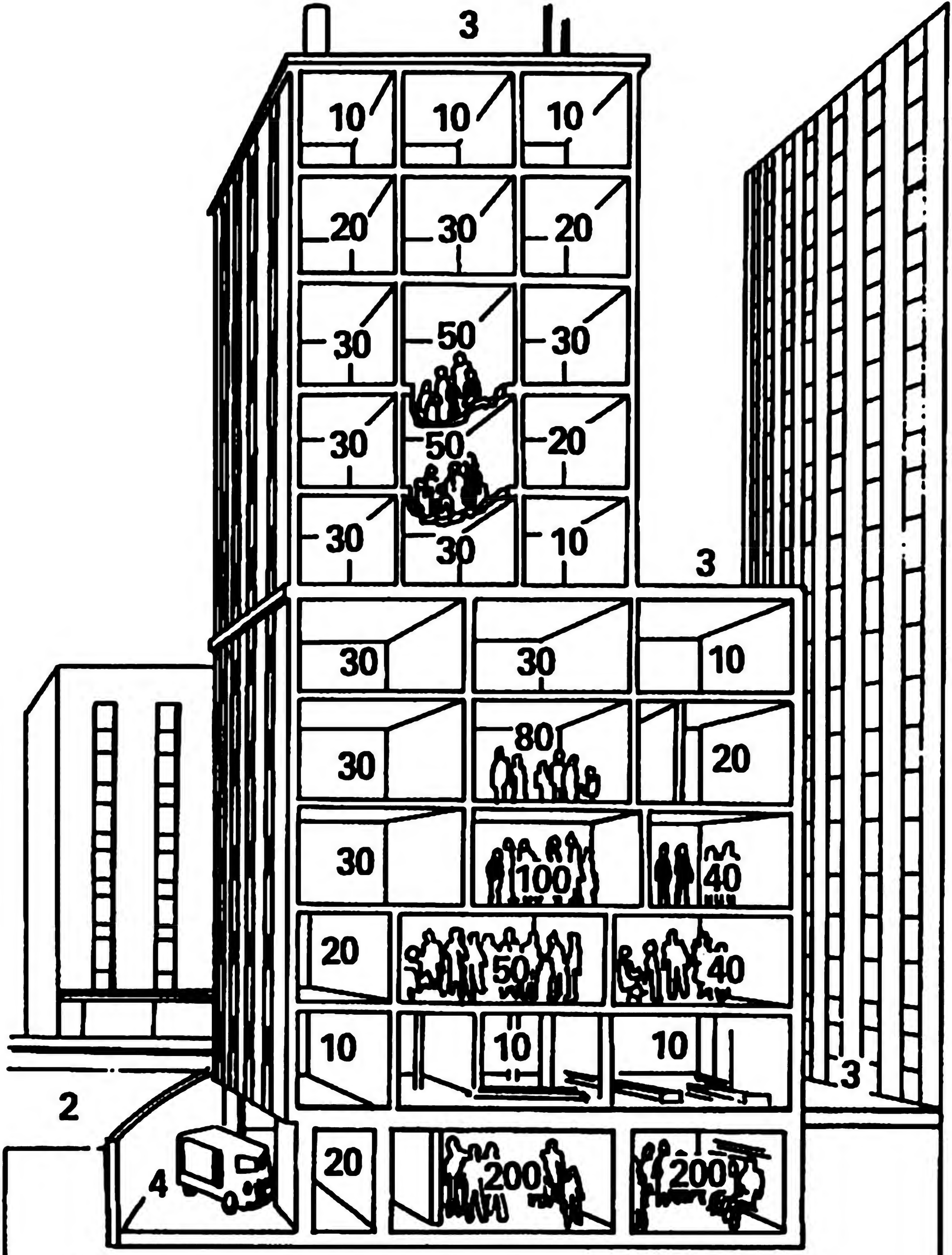
Appointment	*In charge of*	*Composition*	
		Personnel	*Vehicles*
Column Ambulance Officer Deputy Column Ambulance Officer	Ambulance Column comprising one Ambulance Company and one First Aid Company	334 (including drivers for staff cars and D.Rs.)	72 Ambulances 18 Personnel and Equipment Vehicles 10 Staff cars 10 Motor cycles
Company Ambulance Officer Deputy Company Ambulance Officer	Ambulance Company comprising four Ambulance platoons	187 (including drivers for staff cars and D.Rs.)	72 Ambulances 5 Staff cars 4 Motor cycles
Company First Aid Officer Deputy Company First Aid Officer	First Aid Company comprising three First Aid platoons	141 (including drivers for staff cars and D.Rs.)	18 Personnel and Equipment Vehicles 4 Staff cars 3 Motor cycles
Platoon Ambulance Officer Deputy Platoon Ambulance Officer	Ambulance platoon comprising three Ambulance detachments	45 (including driver for staff car)	18 Ambulances 1 Staff car
Platoon First Aid Officer Deputy Platoon First Aid Officer	First Aid platoon comprising six First Aid Parties	45 (including driver for staff car)	6 Personnel and Equipment Vehicles 1 Staff car
Ambulance Detachment Leader Deputy Ambulance Detachment Leader	Ambulance detachment	14	6 Ambulances
First Aid Party Leader Deputy First Aid Party Leader	First Aid party	7 (including driver)	1 Personnel and Equipment Vehicle

Note: Personnel and Equipment Vehicles (PEVs) Staff cars and motor cycles will not be issued for training purposes.

THE MOVEMENT OF AMBULANCES



F.M.A.U. = FORWARD MEDICAL AID UNIT (TRAINED TO APPLY PLASTER OF PARIS TO BROKEN LIMBS, ETC.)



Radiation protection factors in modern city buildings
DCPA Attack Environment Manual, ch. 6, panel 18

SANDIA REPORT
SAND2009-3299
Unlimited Release
Printed May 2009

Analysis of Sheltering and Evacuation Strategies for an Urban Nuclear Detonation Scenario

Larry D. Brandt, Ann S. Yoshimura

Executive Summary

A nuclear detonation in an urban area can result in large downwind areas contaminated with radioactive fallout deposition. Early efforts by local responders must define the nature and extent of these areas, and advise the affected population on strategies that will minimize their exposure to radiation. These strategies will involve some combination of sheltering and evacuation actions. Options for shelter-evacuate plans have been analyzed for a 10 kt scenario in Los Angeles.

Results from the analyses documented in this report point to the following conclusions:

- When high quality shelter (protection factor ~10 or greater) is available, shelter-in-place for at least 24 hours is generally preferred over evacuation.
- Early shelter-in-place followed by informed evacuation (where the best evacuation route is employed) can dramatically reduce harmful radiation exposure in cases where high quality shelter is not immediately available.
- Evacuation is of life-saving benefit primarily in those hazardous fallout regions where shelter quality is low and external fallout dose rates are high. These conditions may apply to only small regions within the affected urban region.
- External transit from a low quality shelter to a much higher quality shelter can significantly reduce radiation dose received if the move is done soon after the detonation and if the transit times are short.

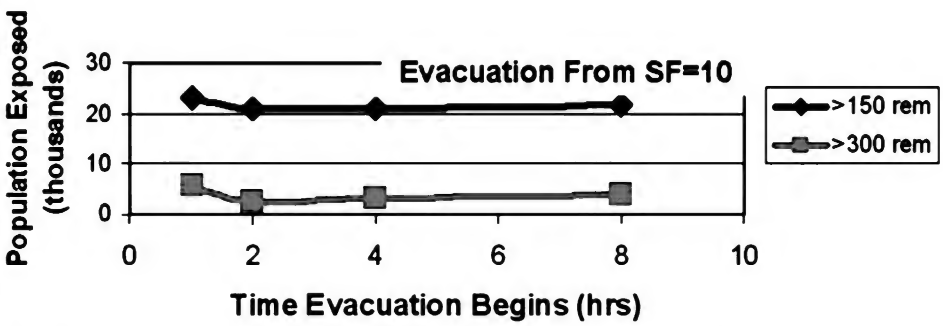
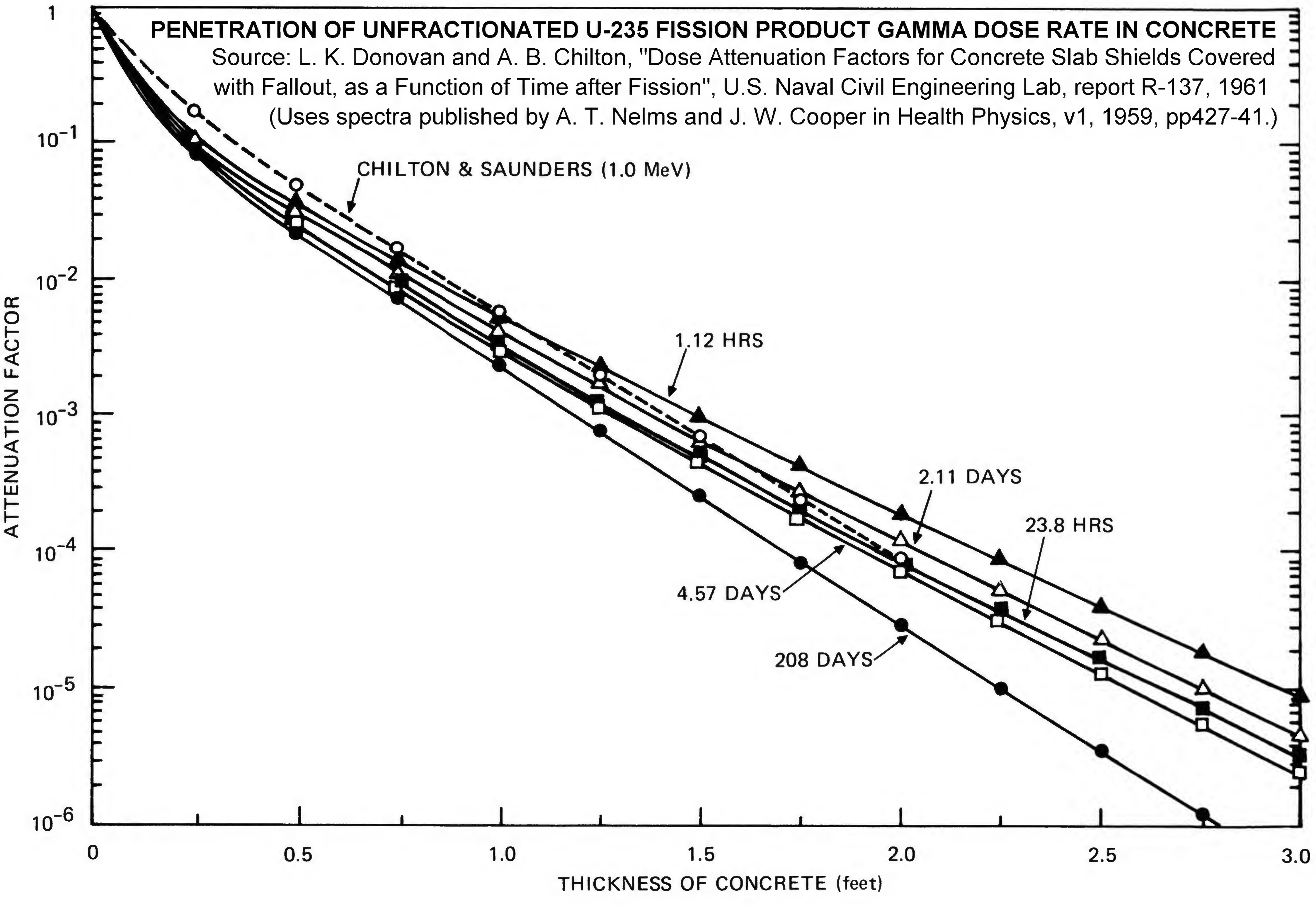


Figure 12. Departure time sensitivities for informed evacuations from shelters with SF=4

Sandia National Laboratories


PENETRATION OF UNFRACTIONATED U-235 FISSION PRODUCT GAMMA DOSE RATE IN CONCRETE
Source: L. K. Donovan and A. B. Chilton, "Dose Attenuation Factors for Concrete Slab Shields Covered with Fallout, as a Function of Time after Fission", U.S. Naval Civil Engineering Lab, report R-137, 1961
(Uses spectra published by A. T. Nelms and J. W. Cooper in Health Physics, v1, 1959, pp427-41.)
CHILTON & SAUNDERS (1.0 MeV)
1.12 HRS
2.11 DAYS
23.8 HRS
4.57 DAYS
208 DAYS
ATTENUATION FACTOR
1
10^-1
10^-2
10^-3
10^-4
10^-5
10^-6
THICKNESS OF CONCRETE (feet)
0
0.5
1.0
1.5
2.0
2.5
3.0

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AND THE CENTRAL OFFICE OF INFORMATION

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The Hydrogen Bomb

HER MAJESTY'S STATIONERY OFFICE

NINEPENCE NET

"The hydrogen bomb has made an outstanding incursion into the structure of our lives and thoughts"

SIR WINSTON CHURCHILL

In 1956 a comprehensive pamphlet on nuclear weapons and their effects was prepared by the Home Office and Scottish Home Department and published by Her Majesty's Stationery Office. Not everyone has the time to read a full technical account of this kind, which is in any case intended chiefly for use in training the civil defence services. There has been a considerable demand for something shorter and this booklet has been prepared to meet that need.

The object is to give, as briefly as possible, the facts about the hydrogen bomb. Knowledge of the effects of this weapon should be widespread. Terrible as these effects are, they can be exaggerated, and the information given in this booklet shows that much could be done to reduce them and to save lives.

This is not intended to serve as a comprehensive manual of instruction to the householder about the steps he could take to help himself and his family should war come: a much fuller booklet is being prepared for this purpose for issue should the need arise; but reference is made to some of the precautions that could be taken.

The publication of this summary does not mean that the Government think war likely. As the 1957 White Paper on Defence made clear, the existence of nuclear weapons and of the means to use them is a safeguard against aggression and a deterrent to war. But everyone should know what these weapons could do, and have some idea of how their effects could be reduced.

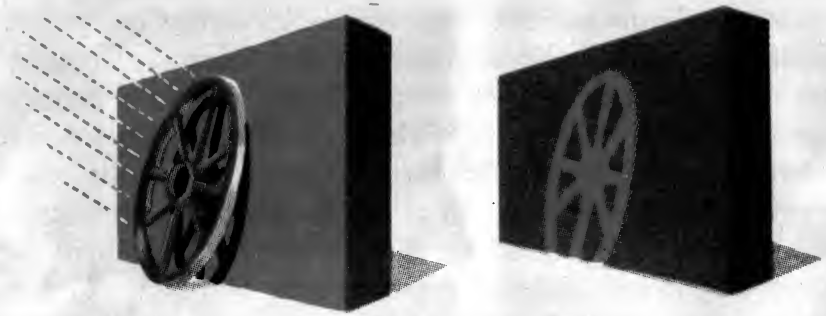
If more information is required, reference should be made to 'Civil Defence Pamphlet No. 1 on Nuclear Weapons, published by Her Majesty's Stationery Office at 2s. 6d.

What a Nuclear Explosion is like . . .

A NUCLEAR BOMB is a device whose explosion results from the sudden release of the vast amount of energy locked up in the core of the atom. This energy is equivalent to the explosion of thousands or even millions of tons of high explosive.

The term " nuclear " includes both atomic and hydrogen bombs. These bombs vary in power just as high explosive bombs do. The atomic bomb dropped on Nagasaki, in Japan, at the end of the last war had a power of twenty thousand tons (or twenty kilotons) of high explosive. In a future war hydrogen bombs with a power of ten million tons (or ten megatons) of high explosive or more might be used. For the purposes of this booklet a ten-million-ton bomb has been assumed. We shall see that such an increase in the size of these terrible weapons does not bring a corresponding increase in their destructive power.

Anything that keeps off the sun's heat will help to give protection against the heat of a nuclear bomb. At Hiroshima, for instance, a painted surface was scorched except where it was in the shadow of a wheel.



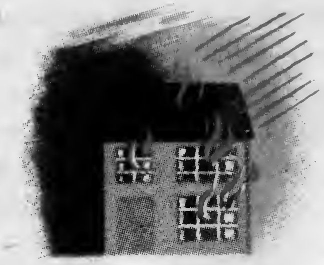
The protection given by clothing depends on the distance from the explosion. The chances of escaping serious burns are increased by wearing hat and gloves and slacks or trousers. At Hiroshima some Japanese women, who had on white cotton dresses with a darker pattern, suffered burns only beneath the pattern. The skin under the white material escaped. This was because white or light-coloured material reflects heat while dark material absorbs it. Colour apart, woollen clothes would be less likely to catch fire than cotton. If clothing did catch fire and there was no time to throw it off, the best way to put out the flames would be to roll over and over on the ground.

All this applies only to people caught in the path of the heat rays. Any solid substance would give full protection against this danger, and a few minutes' warning of the attack would give people time to take cover. Even if they had not heard a warning, people at a distance who took cover even a few seconds after the explosion of a hydrogen bomb would escape some of the heat.

THE DANGER TO BUILDINGS AND THEIR CONTENTS

Any inflammable material exposed to the heat radiated from the fireball may be ignited. Thus lace curtains in windows greatly increase the fire risk as they in their turn might set light to the contents of a room and in the end might cause a general fire in the building. It must be recognised that within three or four miles of a hydrogen bomb all buildings would be completely, or almost completely, destroyed by the blast. Around this central devastated area fires would break out in a number of damaged houses. At Nagasaki the belt of main fires reached a little over a mile from the atom bomb explosion. With a hydrogen bomb it might reach as far as ten miles, although this distance would be reduced on a dull, misty day. Still farther out, fires might be caused by the effects of blast. Gas mains would be burst, electric wires short-circuited and the contents of domestic fires scattered. Such fires might be expected anywhere up to twenty miles from the explosion.

Window panes should be whitewashed and anything inflammable removed from doorways and windows



Otherwise the heat flash will have its best chance to start fires

PRECAUTIONS IN BUILDINGS

Simple precautions can be taken against heat radiation, remembering that brick or stone will not catch fire, but the contents of a house might. The aim would be to prevent as much heat as possible from entering at all. One simple way would be to whitewash the windows. This would block some eighty per cent of the rays and, as they travel at the speed of light, most of the heat would be over and gone before the whitewashed windows could be broken by the slower-moving blast. Also, anything inflammable could be removed from windows and doorways. In built-up areas, the lower storeys would probably be shielded by other buildings. Here a householder would need to pay particular attention to the upper floors with a full view of the sky, and clear the rooms accordingly. If the heat were kept from causing fires by these simple precautions, one of the major hazards would be greatly reduced.

Equally simple measures could be taken to prevent fires caused by blast. Stoves could be shut down, coal and electric fires extinguished, and gas shut off at the main.

Many of the fires caused by a hydrogen bomb could be put out by the methods familiar in the last war : by beating or with a stirrup pump, or with a bucket of sand or water. If his house was not too badly damaged, a householder's first job after an explosion would be to look for such small fires and put them out. Speed would be all-important. Only when they had looked round and dealt with any fires would people take shelter from possible approaching fall-out.

★ ★

The stairs would give some protection against falling debris

Best at resisting pressure are heavily framed steel and reinforced concrete buildings or those with rounded streamlined surfaces. In Nagasaki, for instance, most of the tall factory chimneys survived.

THE DANGER TO PEOPLE

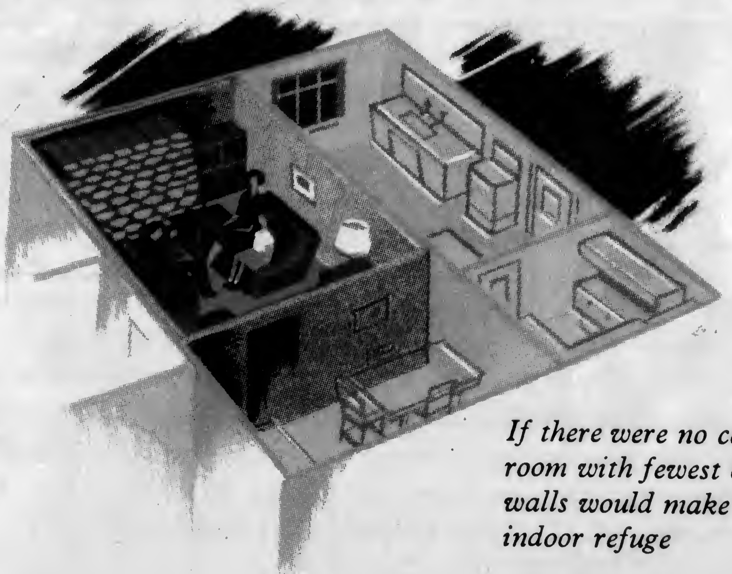
At Hiroshima and Nagasaki very few injuries, such as perforated ear-drums, were caused directly by the blast itself. The real danger is that people would be struck by falling masonry, flying debris or fragments of glass, or might themselves be thrown against some object.

The warning system, however, is designed to enable people to get under cover. A slit trench, especially if covered with a few feet of earth, or a cellar or basement would give good protection. If there were no cellar or basement it would be safest under the stairs, or under a table or bed which would give some protection should the roof or ceiling collapse ; and if there were no time to reach such places before the flash is seen, the best place indoors would be close to an inside wall, avoiding windows or anywhere in the possible path of flying glass.

People caught unprotected in the open could at least try to shelter from the rubble and flying debris, if only in doorways or behind walls or even trees. Failing this, they could fall flat on the ground, with the head and face covered, if possible close to the wall of a substantial building, or in a nearby ditch or gutter.

A slit trench with earth covering protects against blast and radiation

A prepared refuge room inside a house could be made to give good protection against fall-out (although not so good as a covered slit trench) and it would also be much less uncomfortable for a period of two days or more. A cellar or basement would be by far the best place for a refuge room; next best would be the room with the fewest outside walls and the smallest windows. The windows would need to be blocked with solid material, to the thickness of the surrounding walls at least. It would help if the walls themselves were thickened, not necessarily to their full height, with sandbags, boxes filled with earth, or heavy furniture. The occupants of the refuge room would have to remain in it until told that it was safe to come out—perhaps for a period of days—and the room would have to be prepared and equipped accordingly.



If there were no cellar, the room with fewest outside walls would make the best indoor refuge

In some places it might be practicable to make good use of both an outdoor slit trench and an indoor refuge room, using the first for protection against blast, and the second, if the house survived the blast, for subsequent protection against fall-out.

THE ARMED FORCES

Besides the civilian services there would be another important source of help: the Armed Forces. First there would be the Mobile Defence Corps which is organised into fully mobile battalions and especially trained and equipped in rescue and ambulance duties. But all the Armed Forces in the United Kingdom who were not required actively to engage the enemy would have the responsibility of assisting civil defence. Because of the planning and training now in progress they would be able to undertake a wide variety of tasks.

THE NEED FOR CIVIL DEFENCE VOLUNTEERS

The numbers available in the fighting services would, nevertheless, be so small compared with the size of the task that their availability to help in no way lessens the need for civilian forces. The local volunteer would be first in the stricken area and his local knowledge would be needed by any reinforcements coming from farther afield.

CONCLUSION

It is certain that if a nuclear attack were to come, the aid of every man and woman would be needed—service men and civilians alike. Everyone would have to help himself and his neighbour as far as he could. But improvisation would not be enough. The survival of individuals and of groups would depend on plans made beforehand; adequate help for the victims of attack could come only from people trained and organised in advance.

The picture this booklet has painted of a nuclear attack is grim indeed; but it is not hopeless. Much could be done. An efficient Civil Defence organisation, linked with a public that knows the facts, could save millions of lives. The best defence against chaos and confusion would be a resolute spirit of self-reliance, based not on groundless optimism, but on knowledge of the facts. That knowledge is none the less valuable because, as all hope, it may never be used.

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MANUAL OF CIVIL DEFENCE: Vol. I

PAMPHLET No. 1

Nuclear Weapons

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Fire protection and precautions

5.13 *Primary fires* would result from heat flash through windows, open doors, etc., igniting the combustible contents in houses, offices and stores. An obvious fire precaution would be to rearrange the furnishings or equipment and to remove all inflammable material out of the direct path of any heat rays that might enter through windows or other openings. Another very important precaution would be to whitewash windows and skylights as this would keep out about 80 per cent. of the heat radiation. The windows might be broken by the blast wave but as this travels more slowly it would arrive after the heat flash had passed (except of course in the central area of complete destruction where it would not matter).

5.14 The above precautions apply to windows and other openings with a direct view of some part of the sky. In a built-up area they would apply more particularly to the windows of upper floors: even from a high air burst the buildings would have a considerable shielding effect on one another.

5.15 *Secondary fires* might be the consequences of blast damage, scattering of domestic fires, rupture of gas pipes or short-circuiting of electrical wiring. These risks could be reduced if commonsense precautions were taken on receipt of a warning, such as shutting up stoves, covering open fires with sand or earth and by turning off gas and electricity at the mains.

The possibilities of a fire storm

5.16 The chief feature of a fire storm is the generation of high winds which are drawn into the centre of the fire area to feed the flames. These in-rushing winds prevent the spread of the fires outwards but ensure almost complete destruction by fire of everything within the affected area. A fire storm inevitably increases the number of casualties since it becomes impossible for people to escape by their own efforts and they succumb to the effects of suffocation and heat stroke.

5.17 The 20 KT Hiroshima bomb (but not the Nagasaki one) caused a fire storm and fire storms were caused in Hamburg* and in several other cities as a result of heavy incendiary attacks in the last war. A close study of these fire storms and of German cities in which fire storms did not occur revealed several interesting features. A fire storm occurred only in an area of substantial size (i.e. several square miles) heavily built-up with buildings containing plenty of combustible material and where at least every other building in the area had been set alight by incendiary attack.

5.18 It seems unlikely that an initial density of fires equivalent to one in every other building would be started by a nuclear explosion over a British city; studies have shown that a much smaller proportion of buildings than this would be exposed to heat flash (due to shielding). Moreover, the vulnerable centres of many British cities were destroyed in the last war and the new buildings which are replacing them are mainly of fire-resistant construction and less closely spaced. Fire storms after nuclear attack are therefore unlikely in most British cities but the risk would be greatly reduced by adopting the precautions outlined above.

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* About 1,625,000 escaped injury during the fire storm at Hamburg, although out of a population of about 1,700,000 at risk, the 35-40,000 killed represented about 10% of the whole of civilian deaths in Germany from air attack throughout the war.

CHAPTER XI

Summary of Methods of Protection and Decontamination for the Individual

Protective preparations to be taken in an emergency

11.1 All windows and skylights that have a direct view of some part of the sky should be whitewashed. The whitewash would reflect much of the heat of the fireball and so help to stop the heat rays from getting inside the building and setting fire to inflammable objects.

11.2 Attics and lofts should be cleared of all inflammable materials. In other parts of the building, anything inflammable should be removed from the vicinity of windows and other openings, e.g. piles of newspapers on a window-seat or a table near a window.

11.3 Curtains should be removed from windows or made flameproof by soaking in a fire-retardant solution*.

11.4 Baths should be kept full of water and buckets of water should be placed in all rooms for the quick extinction of fires, glowing wood, fabrics, etc.

11.5 The family refuge should be prepared. This should be in the basement or cellar if there is one; otherwise, an innermost room on the ground floor, farthest from external walls and protected by the maximum total thickness of walls on all sides, should be chosen. If a last-war garden shelter is available, the earth-cover should be thickened to about 3 ft.

11.6 The windows of the refuge room should be blocked up or shielded so that they give protection as good as that from the rest of the walls of the refuge, e.g. by erecting a "wall" of sandbags or of boxes filled with earth or sand built up outside the room up to a height of 6 ft. above floor level (or to the top of the window if it is overlooked by trees or by higher ground within 100 ft.).

11.7 Stocks of first aid materials and adequate food supplies for about one week should be collected in or near the refuge: food should be in tins or in waterproof containers or, where appropriate, wrapped in greaseproof paper and put into tins to protect it from plaster, glass and other debris if the house is damaged.

11.8 A supply of drinking water should be stored in jars or bottles, preferably sealed, but at least covered to keep out dust.

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* Suitable solutions for household use are 3 lb. boric acid plus 2 lb. sodium phosphate (or, alternatively, 3 lb. borax plus 2 lb. boric acid) dissolved in 3½ gallons of water. Curtains and fabrics should be thoroughly soaked in the solution and the excess liquid squeezed out before they are rinsed and dried.

11.9 Should there be no indoor W.C., sanitary facilities for use during occupancy of the refuge should be provided.

11.10 In large buildings, natural ventilation should be considered in choosing refuge rooms particularly in a basement. While electrical power remains available, fans should be used either to expel the air from the refuge room through an external vent or to draw fresh air from other spaces within the building. If the building has a forced ventilation system, downward-facing air inlet pipes should be fitted externally and the ends covered with a fine wire gauze screen. If the electrical power fails, sufficient natural ventilation can be achieved if the selected refuge room has an ordinary fireplace and chimney or if it has a ventilation grid near the ceiling opening to the external air, or to some other large space within the building and if, at the same time, the door of the refuge room and all other internal doors on that floor are kept open.

If neither of these conditions is fulfilled, holes could be made near the ceiling in one of the internal walls of each refuge room, opening into larger spaces within the building.

11.11 Bunks or mattresses should be provided as liberally as possible in each refuge room: a person needs nearly twice as much oxygen and exhales twice as much carbon dioxide when sitting as when sleeping and still more when standing and walking about.

Protective measures during and after a nuclear attack

People caught in the open

11.12 No one should be out of doors after a warning of attack had been given except those whose duty required them to do so. Such people would have a specific refuge in mind or at least would know at any moment how to obtain the best protection against the various effects of nuclear weapons.

11.13 If you were out in the open and you saw the flash of the explosion of a nuclear weapon, you might be temporarily blinded but you should try immediately to get behind the best nearby cover that was available, so as to obtain protection from the heat rays and from the effects of the subsequent blast wave and flying debris. Cover on all sides as well as overhead would, of course, be the best: failing that, you should get behind a wall or other solid structure. If there was no other cover, you should lie face down on the ground (in a ditch, gutter or other depression, if possible) using your arms, or a coat or jacket, to cover the head and any exposed skin.

11.14 After the blast wave had passed there would be ample time before the start of fall-out (about half an hour in the case of a large bomb) to enable you to get into a prepared refuge against the fall-out.

People in refuges

11.15 After the blast wave had passed a quick inspection should be made of all rooms in the house or building, including spaces under the roof. Fires which had started and all glowing wood or other material should be extinguished.

11.16 Urgent repairs or weatherproofing which could be completed within half an hour should be done. Curtains or sheets should be tacked over broken windows to keep gross amounts of fall-out from being blown into the rooms. There would be no cause to worry about small amounts of fall-out getting into damaged parts of the house—provided it was not allowed to get into food or water consumed in the refuge room. If dust was visible later in any room it should be swept and dumped outside.

11.17 Except possibly in the area damaged by a nuclear explosion, two separate fall-out warnings* would be given, the *first* to indicate that fall-out was likely, i.e. might arrive at any time after 1 hour and the *second* when it was imminent. After the blast wave had passed and until the imminent warning was received all necessary help and first aid should be given to neighbours.

Protective measures after fall-out had ceased

11.18 You should remain in the refuge for the first 2 days after the explosion or until you had been told that your district was free from radioactive fall-out. If you did not receive any instructions you should stay in your refuge as long as possible (i.e. you should not remain any longer than was necessary in other parts of your house). Above all, you should not go out of doors until you received further instructions. If you were well inside the fall-out area it might not be possible to get further information or instructions to you until the third or even fourth day after the explosion.

11.19 These instructions would tell you how many hours you might safely spend each day out of your refuge (*a*) in other parts of your house (where the shielding is less) and (*b*) outdoors getting food rations and other needs for your family. They would also tell you WHERE and WHEN to go for these food, water and medical supplies so that you would not have to wait and be exposed unnecessarily to a high dose-rate. When you had to go outside for this purpose you should use, if possible, quick means of transport (bicycle or car) so that you could reduce your exposure outdoors to the absolute minimum.

11.20 The advice given to you would depend on the type of house you lived in and amount of shielding it afforded against gamma radiation. The advice would be designed to let you have as much freedom as possible without incurring radiation sickness. It would be essential that you and all members of your family should follow the advice strictly.

11.21 If you did not receive instructions before the end of the third day, it might be because you were in an area of high dose-rate. If so, it would be all the more necessary for you and your family to remain in your refuge room, to spend as little time as possible in other parts of the house and to avoid outdoor exposure until you had been told what you might safely do. 10 R/hr > at 48 hours

11.22 If the dose-rate in your area was above a certain intensity you would be given advance notice of arrangements to clear people from the area street by street or maybe house by house. You would be told exactly WHEN and WHERE you would be collected. You would

* See paragraphs 3.4, 3.5 and 8.9.

"Z Zone" FALLOUT
EVACUATION

have to be ready at the exact time and place; otherwise, you might imperil not only your own life but the lives of those who were accepting heavy risks, carefully calculated in time, in trying to rescue you and your family and neighbours.

Decontamination of skin and clothing

11.23 It has been explained in paragraphs 8.11 to 8.13 that the hazard from contamination on the skin and clothing is a relatively minor one compared with the hazard caused by the general field of gamma radiation from fall-out. If you suspected that you had been contaminated with radioactive fall-out you should use the following decontamination procedure as soon as you got to your refuge:—

(*a*) Remove all outer clothing and place it in a room or cupboard separate from your refuge room. It would be useful to have bags of polythene or similar material into which contaminated articles could be placed since the bags could be handled later with a much smaller risk of spreading the contamination. In removing the outer clothing, care should be taken *not* to shake it as this would disperse radioactive dust unnecessarily into the atmosphere.

(*b*) The hands, head and neck should then be thoroughly washed and scrubbed with soap and warm water while bending over a hand basin. This washing should be repeated at least once, taking care to brush under the nails thoroughly.

11.24 If you had been covered heavily with fall-out, you might develop skin burns on the exposed parts of the body but these would heal normally provided you had not also been exposed to excessive doses of gamma radiation.

11.25 Contaminated clothing can be cleaned to a very considerable extent (almost complete removal of fall-out particles) by either or, where appropriate, both of the following methods:—

(*a*) Removal of dust from the clothing by means of an efficient household vacuum cleaner, or

(*b*) Soaking and stirring the clothing in a solution of household detergent—either 5 minutes in a washing machine or 5 minutes vigorous stirring (with a suitable stick) in a bath or bucket—followed by thorough rinsing in clean water.

Decontamination of roads and paths

11.26 In urban districts, arrangements might have to be made to decontaminate certain roadways and hard paths around houses which had to be used soon after the two-day refuge period and residents might be asked to help. A certain amount of decontamination could be achieved after a land burst by hosing or swilling contaminated hard surfaces with water if drains are available.

1.22 For every weapon there is an optimum height of burst which will produce the greatest blast effect. In kiloton weapons, this optimum height is significantly greater than the critical height at which the fireball will just touch the ground, e.g. for a 20 KT weapon the critical height is 600 ft. and the optimum height of burst is about 1,000 ft. for damage in a typical British city. The corresponding data for a 10 MT weapon are about 1·36 miles for the critical height and about 1·5 miles for the optimum height.
-this height of burst avoids local fallout (no dust enters fireball)

"Clean" and "dirty" bombs

1.23 Fission products are released by all existing types of nuclear weapon. "Dirty" bombs produce a lot and "clean" bombs produce little, the dirtiness depending upon the ratio of fission to fusion in the bomb. The dividing line between "clean" and "dirty" bombs is thus a matter of opinion, but the fission-fusion-fission type of weapon mentioned in paragraph 1.5 would be a "dirty" one.

Possible methods of attack with nuclear weapons

1.24 Weapon design has improved so much that it is possible to incorporate megaton warheads in a variety of weapons, including ballistic missiles with a range of several thousand miles. Possible means of delivery are listed below:—

(i) Manned bombers (subsonic or supersonic).

(ii) Long-range pilotless aircraft released from land or from ships at extreme ranges. (E.G. "V1" CRUISE MISSILE.)

(iii) Long-range guided bombs released from aircraft several hundred miles from the target.

(iv) Ballistic missiles—IRBM's (Intermediate Range Ballistic Missiles) and ICBM's (Inter-Continental Ballistic Missiles)—released at extreme ranges from land, ships off-shore, or from submerged submarines.

(v) Undercover methods of attack. (TERRORISM.)

1.25 Missiles with wings can be guided over the whole range to the target but since they depend on air to feed the engine, to support the wing loading and to exert forces on control surfaces, they are limited in speed and height of operation and are therefore more vulnerable to counter attack than ballistic missiles. The latter can be guided into the correct direction and altitude to reach the target as long as the rocket motor is operating; thereafter they must follow a ballistic path like a shell from a gun. However, ballistic missiles travel for most of their range at altitudes of several hundred miles where there is practically no air resistance and they can reach maximum speeds of 15,000 miles per hour and average range speeds of several thousand miles per hour. Nothing has been disclosed about the accuracy of existing IRBM's or prototype ICBM's but with good equipment and an efficient guidance system, the error in the point of impact should not be greater than the extreme ranges of damage and fire from larger megaton weapons. Ballistic missiles have one weakness as weapons of war—their trajectory takes them above the earth's atmosphere, and the heating effect due to air friction on re-entry may cause them to heat up and become distorted. This can be avoided at the expense of additional complications in design and

reduced size of warhead, but such weapons will remain vulnerable to the intense heat effect from a defensive nuclear missile detonated in the vicinity of the attacking weapon.

1.26 The major problems in countering attacks from IRBM's and ICBM's within the time available between launching and impact are to detect the weapon, to compute its ballistic path and to fire and detonate a defensive nuclear missile at a high altitude and close enough to its path to destroy it. These problems are being studied and may be solved as a result of further advances in radar tracking equipment and high-speed electronic computing machines.

Factors affecting an attack

1.27 The damage to life and property that might be caused by nuclear detonations would depend upon:—

(i) The bomb power, which might be anything from a few kilotons, up to the megaton range.

(ii) The type of burst, e.g. air, water or ground-burst, and where it occurred.

(iii) The prevailing meteorological conditions, i.e. wind strengths and directions at all levels through which radioactive particles might fall.

(iv) The method of attack and the time available for warning the public to take cover: this might be reduced to minutes in an attack with IRBM's or ICBM's.

(v) The protective measures taken before and after the detonation.

(vi) The knowledge of the public of nuclear hazards, and their sense of discipline and readiness to respond to official advice on protective measures.

(vii) The proficiency of all services connected with civil defence in correctly advising the public, in fighting fires and carrying out other life-saving operations.

Estimation of ranges of effects from bombs of different power

1.28 In planning civil defence operations after an attack with nuclear weapons, information would be needed for each detonation on:—

(*a*) The power or yield of the weapon.

(*b*) The time and the location, i.e. ground zero (GZ) of burst.

(*c*) The height of burst.

(*d*) The wind strengths and directions at all levels up to the top of the highest radioactive cloud.

How this information would be obtained is described in Chapter III.

1.29 When the above facts were known, simple methods would be required for estimating quickly the ranges of the various effects produced by the weapon sizes used. Such estimates would be needed to assess the overall magnitude of the civil defence problems and tasks and they would include the ranges of varying degrees of structural damage, of road blockage, of fires and skin burns and of the main

TABLE 15 PAGE 42:

Downwind contamination

Areas of contours at 7 hours after burst, assuming 100 per cent. fission yield

Reference contour dose-rate r.p.h. at 7 hours after burst (DR7's)	*Areas in square miles for weapon power*						
	20 KT	*100 KT*	*½ MT*	*1 MT*	*2 MT*	*5 MT*	*10 MT*
300	0.2	1.2	27	54	108	270	540
100	1.3	6.4	105	210	420	1,050	2,100
30	5	25	325	650	1,300	3,250	6,500
10	16	82	750	1,500	3,000	7,500	15,000
3	50	250	1,650	3,300	6,600	16,500	33,500
1	200	1,000	4,250	8,500	17,000	42,500	85,000

"Z Zone" for evacuation at 48 hours (10 R/hr at 48 hrs = 100 R/hr at 7 hours, due to decay)

PAGE 49:

TABLE 18

Half value thicknesses of shielding materials against residual radiation

Material	*Slab density lb. per square foot and per inch thickness*	*Half value thickness (inches)*
Steel ..	41	0.7
Concrete ..	12	2.2
Brickwork	10	2.8
Earth ..	8	3.3

Thus a 2·2 in. thickness of concrete will reduce the dose of residual radiation to one-half of its original value, 4·4 in. will reduce it to a quarter, 6·6 in. to one-eighth and so on. Brick walls 4½, 9 and 13½ in. thick will reduce the intensity of residual radiation by factors of 3, 10 and 30 respectively. As shields are made thicker and larger the contribution from scattered radiation which penetrates increases, so that the reduction factor is slightly more for thinner shields and slightly less for thicker shields than those indicated above.

* The energy of gamma radiation is usually expressed in units of a million electron volts (Mev): the gamma ray released when a nitrogen atom captures a neutron may exceed 10 Mev: the average energy of initial gamma radiation is 4.5 Mev whereas that of residual radiation from fall-out is only about 0.7 Mev. - page 23

† These data are taken from more elaborate data in the series of curves on page 352 of the U.S. publication " The Effects of Nuclear Weapons " (see Preface) where similar curves for neutron and neutron plus gamma doses are shown on pages 366 and 372.

Survey of dwelling houses in the United Kingdom

PAGE 52:

9.21 Surveys have been made of different types of dwelling houses in the United Kingdom and their protective factors have been calculated for ground floor refuge rooms in which there is no external door and the windows have been blocked. For this purpose it was assumed that the fall-out is uniformly distributed on the roof and on the ground around the building. The calculated protective factors (which are approximate) are shown in Table 21.

TABLE 21

Approximate protective factors in ground floor refuge rooms of typical British houses with timber upper floors

Types of house	*Protective factor*
Prefab	3
Bungalow	5–10
Detached two-storey	15
Semi-detached two-storey 11 in. cavity walls ..	25–30
Semi-detached two storey $13\frac{1}{2}$ in. brick walls ..	40
Terraced two-storey	45
Terraced back to back	60
Tenements	*

There is some evidence that the fall-out may not all remain on sloping roofs and that consequently the protective factors of most British houses will be higher than the values given in Table 21: this applies especially to the houses with the lower protective factors where a large fraction of the radiation comes from contamination on the low roof.

Basements and trenches

9.22 A substantial increase in protection could be obtained if any of the above houses had an additional cellar or basement, or a trench under the floor: e.g. for a two-storey house the trench would give a protec-

* See paragraph 9.1. Protective factors in tenements can vary widely as they depend upon the size of the building, the massiveness of its construction and the number of storeys used as refuges. On the ground and first floors, PF's may vary from 100 to 500, on second floors the PF may be 50 and on top floors they may be in the neighbourhood of 20.

tive factor (PF) of about 200 and the basement a PF of between 140 and 340, depending on whether or not the basement was adjacent to a semi-sunk area, and if so, on the size of the latter.

9.23 A slit trench with even a light cover of wooden boards or corrugated iron and a tarpaulin will give a protective factor of 5 to 10 and with an additional 3 ft. of earth cover the protective factor will be very high (e.g. 200 to 300 or more).

10.8 The main sources of drinking water in the United Kingdom are underground wells, rivers and impounding reservoirs fed from catchment areas. Wells and reservoirs each supply slightly more than a third of the population and rivers just under a third. *Underground sources* of water would, in general, be free from contamination but if the water is stored in open reservoirs there is a possibility of contamination. *In rivers* many of the fall-out particles would sink to the bottom or be held in mud and vegetation. Some of the active material which dissolves in the river water would be absorbed by mud and vegetation and the rest would ultimately flow to the sea. It seems reasonable to expect that river water would not be contaminated above emergency levels for long periods.

10.9 The large surface areas of *impounding reservoirs* are open to fall-out and the contamination of the water to hazardous levels is therefore possible. It is worth noting in this connection that one of the normal methods of water softening in current use in some industries, known as the base or ion-exchange process, could remove nearly all the radioactive matter dissolved from fall-out.

10.10 As explained in paragraph 10.7 it is proposed to cut off water which is contaminated above the tolerance levels. It is not possible to say for how long, because this would depend upon the level of contamination and the availability of other supplies of fresh water. It would be important for householders to store as much water as possible in order to provide a reserve supply for emergency use. The utmost economy should be exercised in the use of these supplies, some of which should be kept near the emergency refuge.

Industrial cooling water

10.11 Many industrial installations have a small reservoir and recirculating system for cooling water. If possible, the exposed water surfaces should be covered to prevent entry of heavy fall-out. If fall-out did enter, much of it would sink to the bottom or become absorbed in growths on the bottom and walls of the reservoir, and if the depth of water was more than three to four feet, it would be an adequate radiation shield. Provided the water was *not* used for human consumption the soluble radioactive content would present a negligible external radiation hazard when the cooling system was in use.

Sewage disposal

10.12 The harmless disposal of sewage normally depends at some stage on the action of micro-organisms. The risk of injury to the micro-organisms by fall-out is negligible. The main hazard would be possible leakage of radio-strontium, radio-barium and radio-caesium through the sewage plant into a river used as a source of drinking water not far downstream.

10.13 In the event of widespread fall-out in built-up areas, much of the fall-out might be washed by rainfall or in decontamination operations down the gutters and into street drains. To a large extent it would be trapped there until it decayed but it would not constitute

a significant hazard to the public because of the depth of the drains underground. Collaboration of sewage, water and river authorities would be necessary to dispose of the contaminated drainage with least harm to water supplies and to sewage plant, e.g. by arrangement to by-pass it through storm overflows and to stop drawing drinking water supplies from the river during this period.

Food stocks

10.14 It is not the purpose of this pamphlet to review the administrative problems which would face the Ministry of Agriculture, Fisheries and Food after the widespread destruction and the disruption of communications and transport consequent on a nuclear attack on this country. Official reviews of these problems and of the steps being taken to deal with them have been published elsewhere*. This section will be confined, therefore, to basic advice for the protection of people and animals, and their sources of food.

10.15 Many communities isolated by heavy fall-out would have to rely on their available local stocks of food, including that in houses and retail shops, for an indefinite period until arrangements could be made for emergency feeding. It is of vital importance, therefore, that no food be wasted. The monitoring organisation will separate clean from contaminated food and unless the latter is perishable it must be retained until specialist advice has been obtained on how to salvage the maximum amount.

10.16 *Gamma radiation has no harmful effect on foodstuffs* except at dose-rates far in excess of those likely to be encountered where food survives any nuclear detonation. Neutron bombardment might induce some radioactivity but this would not occur outside the area of complete destruction and by the time such food could be salvaged it would be safe to consume. The only significant hazard to food, apart from growing crops, would be the deposition on it of radioactive fall-out which might eventually find its way into the human body. Food contained in impervious wrappings would be safe to eat provided that the wrapping had not been damaged physically. It would be safe to eat provided care was taken to remove the fall-out from the exterior of the container and to prevent contamination of the contents when the container was opened. This would apply also to food in paper wrappings provided the paper had not been soaked with wet fall-out or by subsequent rain (see paragraphs 1.19 and 10.3).

Growing crops

10.17 Heavy fall-out would, of course, preclude any possibility of lifting crops until the dose-rate had fallen sufficiently to permit limited and calculated exposure periods. Crops contaminated with fall-out would need careful handling to prevent the transfer of radioactive matter to the skin, hair or clothing and thence into the mouth or into cuts and abrasions.

10.18 Root crops should be fit for consumption after thorough washing, and so should peas and beans in the pod if the pods were washed before, and the peas after shelling. The hearts of cabbage, sprouts and lettuce should be thoroughly washed after discarding the outer

*** See footnote to paragraph 10.2.**

(REFERENCE: Dr John F. Loutit and Dr R. Scott Russell "Operation Buffalo, Part 5, The entry of fission products into food chains", Atomic Weapons Research Establishment, report AWRE-T-57/58, May 1959, 216 pages: 90% of Buffalo-2 ground burst fallout was removed from wheat by threshing it. 90% was in the chaff removed by threshing, only 10% on grain.)

leaves. Hard skin-fruits could be washed and peeled but soft fruits should be discarded. Flour produced from cereal contaminated with fall-out would contain only a small fraction of the original contamination. ⇒ 10% for Buffalo-2 nuclear test, see report AWRE-T57/58.

10.19 The effect of fall-out on crops would depend upon their state of growth at the time: if they were in the early stages of growth they would absorb radioactive matter through the root system as well as becoming contaminated on the leaves or other parts above ground. The contamination of the soil present farmers with many other long-term problems. Most of the radioactive components in fall-out would not be washed deeply into the soil but would be retained in the top few inches, and it would be generally advantageous to dig or plough the contamination deeply into the soil and to add lime where there was lime deficiency as this would reduce the uptake by plants of any traces of radioactive strontium which might be present.

"LIME" = Calcium Salts, eg $CaCO_3$

Livestock + add potassium chloride to block Cs-137

10.20 Livestock are affected by fall-out and by radiation in much the same way as human beings. They can suffer radiation sickness, skin burns from fall-out and internal injury to the gastro-intestinal tract when fall-out is swallowed in food or water. As in human beings radio-iodine accumulates in the thyroid gland and radio-strontium accumulates in the bones of animals. In general, the lethal dose depends on size, but among larger animals cattle and horses are slightly more sensitive and sheep and pigs slightly less sensitive than human beings. Except for dairy cattle and breeding stocks, the long-term effects of radiation would be of little consequence because, normally, the animals would be slaughtered long before these effects could become manifest.

10.21 The flesh of animals exposed to initial gamma flash or to residual radiation from fall-out (unless they are in the last stages of illness) would be fit for human consumption provided the bones and the offal were discarded.

10.22 Where practicable, animals should be put under cover and fed with clean food and water, priority being given to breeding stock and dairy cattle.

Milk and eggs

10.23 Cattle secrete in the milk a considerable proportion of the radio-iodine and radio-strontium they absorb. It is anticipated that over large areas of the country the milk produced by cows grazing in the open would be unsafe for infants fed entirely on milk. If facilities were available it would be possible to save contaminated milk by converting it into butter and cheese and storing these products until the radioactivity had decayed, or, in the last resort, by feeding it to animals, e.g. pigs and poultry.

5. It is not possible for a nucleus to consist of protons alone, because the repulsive forces between the positive charges would make them fly apart: in nuclei containing more than one proton this is prevented by the presence of the neutrons and by the attractive forces between the different fundamental particles in close proximity. The atoms of all the elements, with the exception of the simplest type of hydrogen atom, contain at least as many neutrons as protons and the larger the nucleus, the greater is the excess of neutrons over protons needed to hold the nucleus together.

6. All atoms of one element contain the same number of protons but they may have different numbers of neutrons. Thus, several atomic species of the same element are possible and these are called *isotopes* of that element. There is a limit to the number of possible isotopes of each element and those which contain too many or too few neutrons are unstable or radioactive and disintegrate sooner or later, by expelling neutrons or electrons (resulting from the conversion of neutrons to protons) in order to restore the balance in the ratio of neutrons to protons needed for stability. Under those circumstances the electron expelled at high speed from the nucleus is called a beta particle. A succession of changes or disintegration may occur before a stable nucleus is formed and, in many of these, excess energy may be emitted also in the form of gamma rays, an electromagnetic radiation like light or X-rays but of much shorter wavelength. A frequent occurrence, particularly among heavier radioactive atoms, is the expulsion of an alpha particle which is, in fact, the nucleus of the gaseous element helium (containing two protons and two neutrons) without its two outer electrons.

12. Published information suggests that an unconfined sphere of U-235 metal of about 6½ in. diameter and weighing about 48 kilograms would be a critical amount: this would be reduced to about 4½ in. diameter (16 kg.) for a U-235 sphere enclosed in a heavy tamper. The critical sizes for U-233 and Pu-239 have not been disclosed but are somewhat smaller than for U-235. The increasing mechanical complication of bringing together, rapidly and simultaneously, a number of sub-critical pieces of fissile material sets a practical limit to the power of nuclear fission weapons.

Nuclear fission and thermonuclear weapons

13. A temperature of several million degrees centigrade is reached in the detonation of a nuclear fission weapon. At this temperature atoms are stripped of most of their surrounding cloud of electrons and the nuclei move at very high speeds experiencing many collisions with one another. Under these circumstances the nuclei of the rarer hydrogen isotopes deuterium and tritium have enough energy of motion to overcome the repulsive forces between their single positive electrical charges and they are able to fuse together. The energy released in the fusion of these two nuclei is about one-twelfth of that released in the fission of a single U-235 nucleus, but on an equal weight basis, the fusion energy is about two and a half times as large as the energy of fission of U-235.

14. In the process of fusion a neutron is released at a very high speed from each pair of reacting nuclei and it has enough energy to split the commoner atoms of U-238. Thus, if U-238 metal is used as the bomb case in a thermonuclear weapon the quantity of fission products will be increased many times. This type of weapon is the fission-fusion-fission type or so-called "dirty" bomb.

HOME OFFICE

SCOTTISH HOME DEPARTMENT

MANUAL OF CIVIL DEFENCE

Volume I

PAMPHLET No. 1

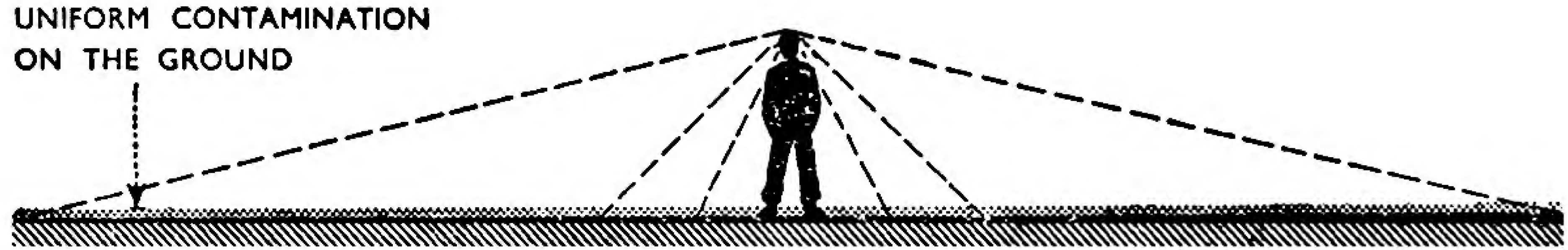
NUCLEAR WEAPONS

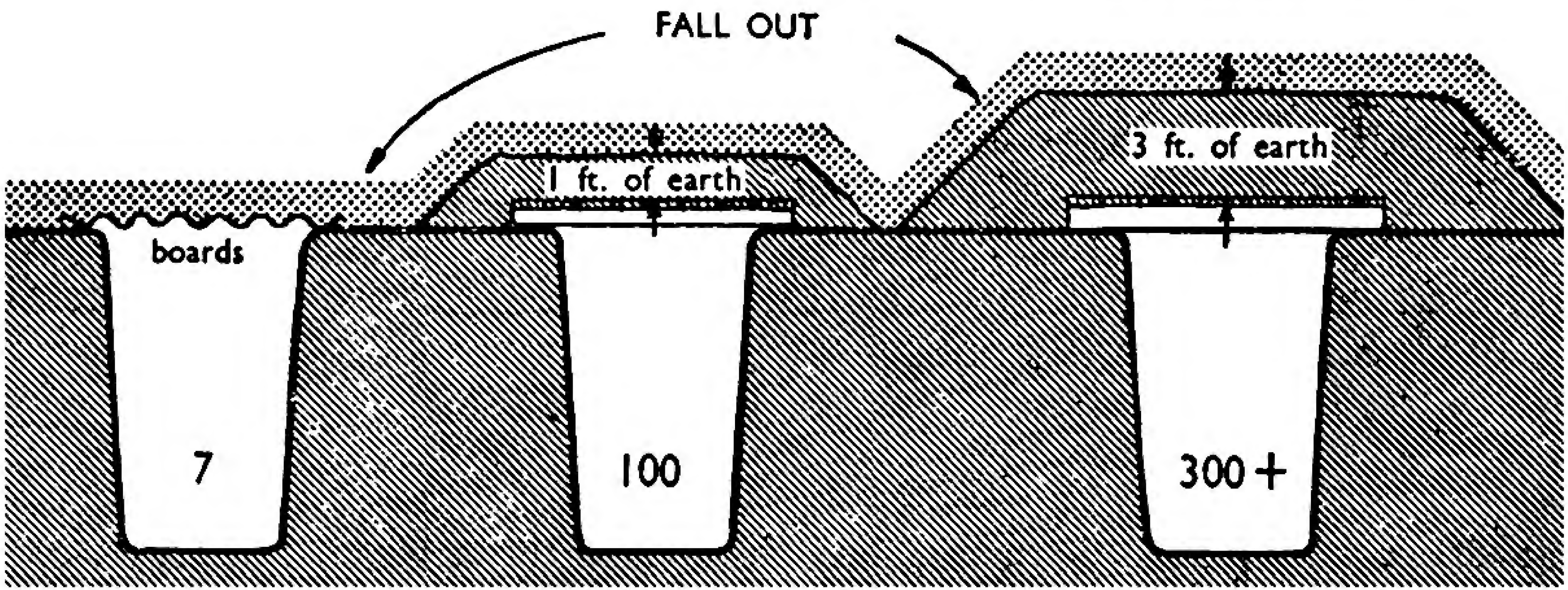
LONDON

HER MAJESTY'S STATIONERY OFFICE

1956

CONTENTS





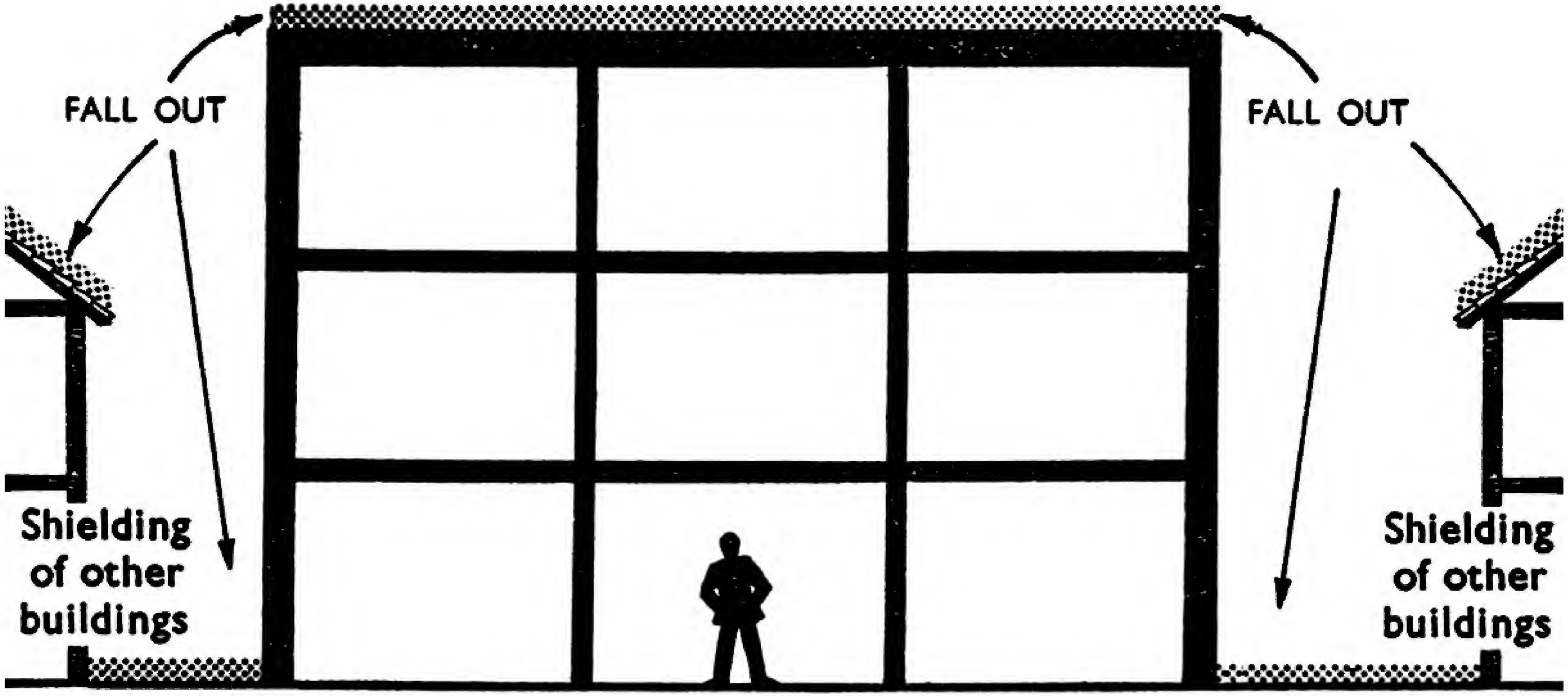
Protection factors in slit trenches (the factor by which the outside dose is divided to get the inside dose).

Choosing a refuge room

In choosing a refuge room in a house one would select a room with a minimum of outside walls and make every effort to improve the protection of such outside walls as there were. In particular the windows would have to be blocked up, e.g. with sandbags.

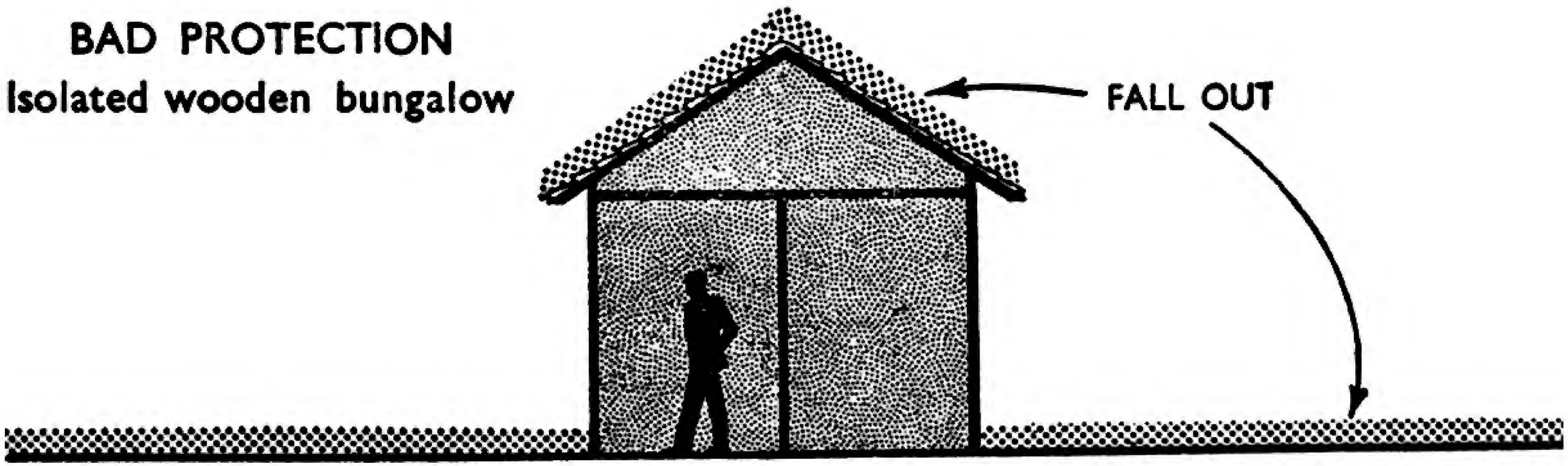
GOOD PROTECTION

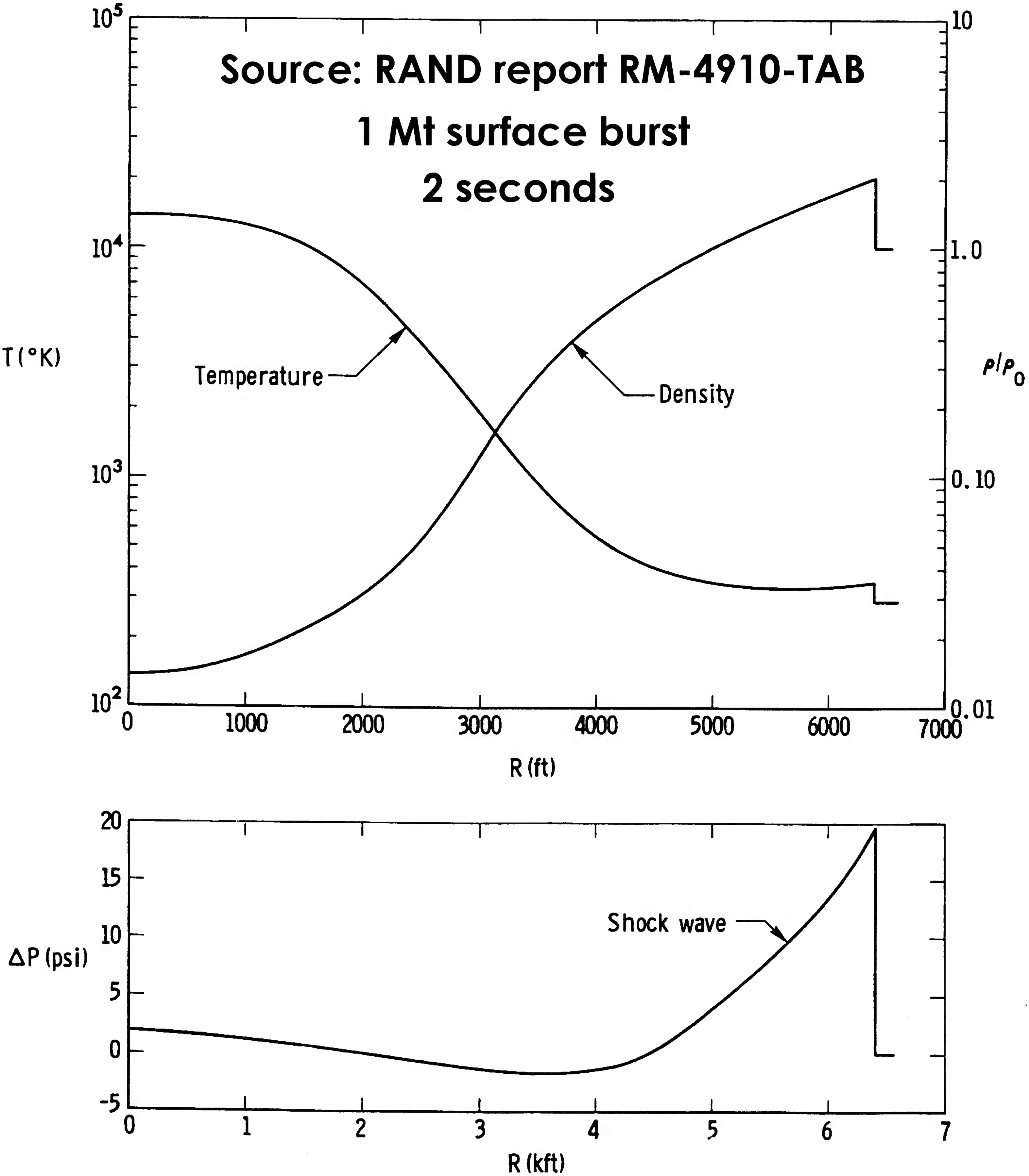
Solidly constructed multi-storeyed building



BAD PROTECTION

Isolated wooden bungalow




Source: RAND report RM-4910-TAB
1 Mt surface burst
2 seconds
T (°K)
Temperature
Density
ρ/ρ0
R (ft)
ΔP (psi)
Shock wave
R (kft)

The Effects of

Nuclear Weapons

SAMUEL GLASSTONE
Editor

Revised Edition
Reprinted February 1964

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UNITED STATES DEPARTMENT OF DEFENSE
Published by the
UNITED STATES ATOMIC ENERGY COMMISSION
April 1962

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Foreword

This book is a revision of "The Effects of Nuclear Weapons" which was issued in 1957. It was prepared by the Defense Atomic Support Agency of the Department of Defense in coordination with other cognizant governmental agencies and was published by the U.S. Atomic Energy Commission. Although the complex nature of nuclear weapons effects does not always allow exact evaluation, the conclusions reached herein represent the combined judgment of a number of the most competent scientists working on the problem.

There is a need for widespread public understanding of the best information available on the effects of nuclear weapons. The purpose of this book is to present as accurately as possible, within the limits of national security, a comprehensive summary of this information.

Secretary of Defense

Chairman
Atomic Energy Commission

12.11 In Japan, where little evasive action was taken, the survival probability depended upon whether the individual was outdoors or inside a building and, in the latter case, upon the type of structure. At distances between 0.3 and 0.4 mile (530 and 700 yards) from ground zero in Hiroshima the average survival rate, for at least 20 days after the nuclear explosion, was less than 20 percent. Yet in two reinforced-concrete office buildings, at these distances, almost 90 percent of the nearly 800 occupants survived more than 20 days, although some died later from radiation injury.

These facts bring out clearly the greatly improved chances of survival from a nuclear explosion that could result from the adoption of suitable warning and protective measures.

TABLE 12.29—ARRIVAL TIME FOR PEAK OVERPRESSURE

Distance (miles)	*Explosion yield*				
	1 KT	*10 KT*	*100 KT*	*1 MT*	*10 MT*
			(Time in seconds)		
1	4. 3	3. 6	3. 7	2. 5	1. 5
2	9	8. 1	7. 4	6. 5	5. 0

12.35. The major part of the thermal radiation travels in straight lines, and so any opaque object interposed between the fireball and the exposed skin will give some protection. This is true even if the object is subsequently destroyed by the blast, since the main thermal radiation pulse is over before the arrival of the blast wave.

12.36 At the first indication of a nuclear explosion, by a sudden increase in the general illumination, a person inside a building should immediately fall prone, as described in § 12.30, and, if possible, crawl behind or beneath a table or desk or to a planned vantage point.

12. 72 Because of its particulate nature, fallout will tend to collect on horizontal surfaces, e.g., roofs, streets, tops of vehicles, and the ground. In the preliminary decontamination, therefore, the main effort should be directed toward cleaning such surfaces. The simplest way of achieving this is by water washing, if an adequate supply of water is available. The addition of a commercial wetting agent (detergent) will make the washing more efficient. The radioactive material is thus tranferred to storm sewers where it is less of a hazard.

Nevada in 1953.

before exposure to a nuclear explosion

after exposure to a nuclear explosion

7.59 The value of fire-resistive furnishing in decreasing the number of ignition points was also demonstrated in the tests. Two identical, sturdily constructed houses, each having a window 4 feet by 6 feet facing the point of burst, were erected where the thermal radiation exposure was 17 calories per square centimeter. One of the houses contained rayon drapery, cotton rugs, and clothing, and, as was expected, it burst into flame immediately after the explosion and burned completely. In the other house, the draperies were of vinyl plastic, and rugs and clothing were made of wool. Although much ignition occurred, the recovery party, entering an hour after the explosion, was able to extinguish the fires.

7.76 It should be noted that the fire storm is by no means a special characteristic of nuclear weapons. Similar fire storms have been reported as accompanying large forest fires in the United States, and especially after incendiary bomb attacks in both Germany and Japan during World War II. The high winds are produced largely by the updraft of the heated air over an extensive burning area. They are thus the equivalent, on a very large scale, of the draft of a chimney under which a fire is burning. Because of limited experience, the conditions for the development of fire storms in cities are not well known. It appears, however, that some, although not necessarily all, of the essential requirements are the following: (1) thousands of nearly simultaneous ignitions over an area of at least a square mile, (2) heavy building density, e.g., more than 20 percent of the area is covered by buildings, and (3) little or no ground wind. Based on these criteria, only certain sections—usually the older and slum areas—of a very few cities in the United States would be susceptible to fire storm development.

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[redacted]

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By Authority of Memo, Ch.
By G. Homos / Ch. Date OCT 2 4 1957

HANDBOOK

on

CAPABILITIES

of

ATOMIC WEAPONS

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10.3 Damage Criteria

10.32 For those items not included in Table VIII, select the listed item most similar in those characteristics discussed previously as being the important factors in determining the extent of damage to be expected. Perhaps the most important item to be remembered when estimating effects on personnel is the amount of cover actually involved. This cover depends on several items; however, one factor is all important, namely, the degree of forewarning of an impending atomic attack. It is obvious that only a few seconds warning is necessary under most conditions in order to take fairly effective cover. The large number of casualties in Japan resulted for the most part from the lack of warning.

TABLE VIII

ITEM	DAMAGE	AIR SHOCK PSI	REMARKS
Artillery Field (75mm or greater)	Severe	40	Damage to Gun and Cradle
	Moderate	30	Damage to Recoil and Carriage
	Light	5	Damage to Gun Sights
Artillery Field (Less than 75mm)	Severe	25	Damage to Gun and Cradle
	Moderate	15	Damage to Recoil and Loading Mechanism
	Light	5	Damage to Sights
Reinforced Concrete Bldgs.	Severe	25	Collapse
	Moderate	10	Structural damage
	Light	3	Plaster & window damage
Steel, heavy frame Bldgs.	Severe	18	Mass distortion
	Moderate	12	Structural Damage
	Light	3	Plaster & window damage
Steel, light frame Bldgs.	Severe	10	Mass distortion
	Moderate	5	Structural Damage
	Light	3	Plaster & window damage

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DEPARTMENT OF THE ARMY TECHNICAL MANUAL
DEPARTMENT OF THE NAVY
DEPARTMENT OF THE AIR FORCE
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TM 23-200
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NAVMC 1104 REV

CAPABILITIES OF ATOMIC WEAPONS (U)

Prepared by
Armed Forces Special Weapons Project

DEPARTMENTS OF THE ARMY, THE NAVY AND THE AIR FORCE

REVISED EDITION NOVEMBER 1957

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Personnel in structures. A major cause of personnel casualties in cities is structural collapse and damage. The number of casualties in a given situation may be reasonably estimated if the structural damage is known. Table 6–1 shows estimates of casualty production in two types of buildings for several damage levels. Data from Section VII may be used to predict the ranges at which specified structural damage occurs. Demolition of a brick house is expected to result in approximately 25 percent mortality, with 20 percent serious injury and 10 percent light injury. On the order of 60 percent of the survivors must be extricated by rescue squads. Without rescue they may become fire or asphyxiation casualties, or in some cases be subjected to lethal doses of residual radiation. Reinforced concrete structures, though much more resistant to blast forces, produce almost 100 percent mortality on collapse. The figures of table 6–1 for brick homes are based on data from British World War II experience. It may be assumed that these predictions are reasonably reliable for those cases where the population is in a general state of expectancy of being subjected to bombing and that most personnel have selected the safest places in the buildings as a result of specific air raid warnings. For cases of no prewarning or preparation, the number of casualties is expected to be considerably higher.

6–2

Glass breakage extends to considerably greater ranges than almost any other structural damage, and may be expected to produce large numbers of casualties at ranges where personnel are relatively safe from other effects, particularly for an unwarned population.

Table 6–1. Estimated Casualty Production in Structures for Various Degrees of Structural Damage

	Killed outright	Serious injury (hospitalization)	Light injury (No hospitalization)
1–2 story brick homes (high explosive data):	*Percent*	*Percent*	*Percent*
Severe damage	25	20	10
Moderate damage	<5	10	5
Light damage	......	<5	<5

Note. These percentages do not include the casualties which may result from fires, asphyxiation, and other causes from failure to extricate trapped personnel. The numbers represent the estimated percentage of casualties expected at the maximum range where the specified structural damage occurs.

Personnel in a prone position are less likely to be struck by flying missiles than those who remain standing.

6–3

Table 6–2. Critical Radiant Exposures for Burns Under Clothing

(Expressed in cal/cm² incident on outer surface of cloth)

Clothing	Burn	1 KT	100 KT	10 MT
Summer Uniform	1°	8	11	14
(2 layers)	2°	20	25	35
Winter Uniform	1°	60	80	100
(4 layers)	2°	70	90	120

6–4

3.1 General

For a surface burst having the same yield as an air burst, the presence of the earth's surface results in a reduced thermal radiation emission and a cooler fireball when viewed from that surface. This is due primarily to heat transfer to the soil or water, the distortion of the fireball by the reflected shock wave, and the partial obscuration of the fireball by dirt and dust (or water) thrown up by the blast wave.

~~CONFIDENTIAL~~ 3–1

Measurements from the ground of the total thermal energy from surface bursts, although not as extensive as those for air bursts, indicate that the thermal yield is a little less than half that from equivalent air bursts. For a surface burst the thermal yield is assumed to be one-seventh of the total yield.

3–2 ~~CONFIDENTIAL~~

$$Q=\frac{3.16\times 10^6\ W\ (\overline{T})}{D^2}\ \text{cal/sq cm (air burst).}$$

and

$$Q=\frac{1.35\times 10^6\ W\ (\overline{T})}{D^2}\ \text{cal/sq cm (surface burst).}$$

where Q=radiant exposure (cal/sq cm)
$\overline{T}$=atmospheric transmissivity
W=weapon yield (KT)
D=slant range (yds).

~~CONFIDENTIAL~~ 3–3

The differences between the air burst and surface burst curves are caused by the difference in apparent radiating temperatures (when viewed from the ground) and the difference in geometrical configuration of the two types of burst.

50 mile visibility and 5 gm/m³ water vapor.
10 mile visibility and 10 gm/m³ water vapor.

3.3 Radiant Exposure vs. Slant Range

a. Spectral. Characteristics. At distances of operational interest, the spectral (wavelength) distribution of the incident thermal radiation, integrated with respect to time, resembles very closely the spectral distribution of sunlight. For each, slightly less than one-half of the radiation occurs in the visible region of the spectrum, approximately one-half occurs in the infrared region and a very small fraction (rarely greater than 10 percent) lies in the ultraviolet region of the spectrum. The color temperature of the sun and an air burst are both about 6,000° K. A surface burst, as viewed by a ground observer, contains a higher proportion of infrared radiation and a smaller proportion of visible radiation than the air burst, with almost no radiation in the ultraviolet region. The color temperature for a surface burst is about 3,000° K. A surface burst viewed from the air may exhibit a spectrum more nearly like an air burst.

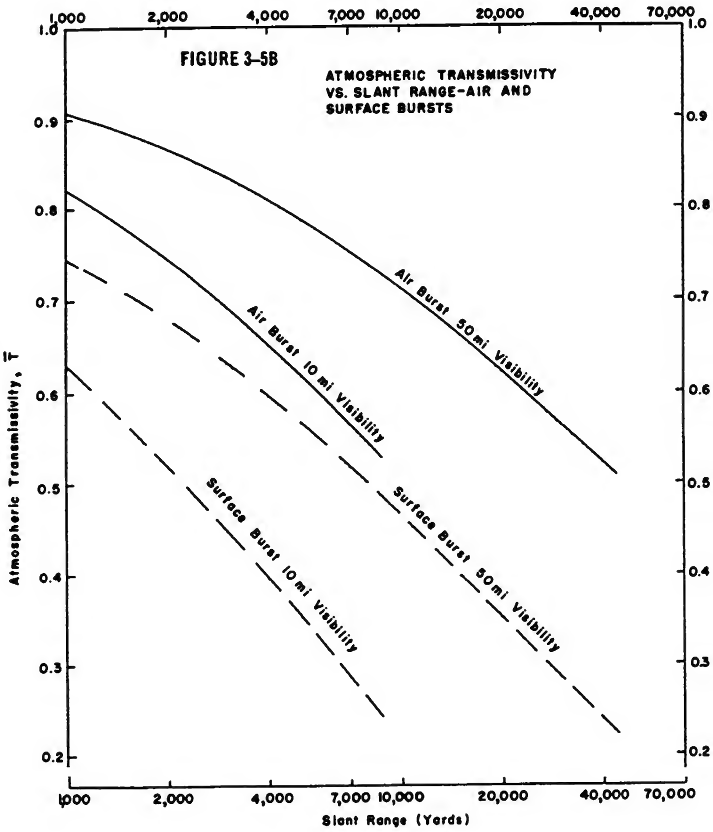


FIGURE 3–5B ATMOSPHERIC TRANSMISSIVITY VS. SLANT RANGE–AIR AND SURFACE BURSTS

Table 12–2. Critical Radiant Exposure Values for Various Materials

Material	Damage	Critical radiant exposure Q_c (cal/sq cm)		
		1 KT	100 KT	10 MT
Sandbags: Cotton canvas, dry, filled	Failure	10	18	32
Wood, white pine	0.1 mm depth char	10	18	32
White pine, given protective coating	0.1 mm depth char	40	71	126

SECTION VII
DAMAGE TO STRUCTURES

7.1 General

Tunnels in solid rock are difficult to destroy by explosions of nuclear weapons. In this case, the shock wave is transmitted through the rock. When it reaches the tunnel the wave is reflected as a tensile wave, and there is a tendency for the rock to spall or become detached from the rock-tunnel interface. Use of tunnel linings materially reduces this spalling. Mass crushing of the rock and filling of the tunnel occurs closer to the burst point.

7.4 Field Fortifications

a. Air Blast. Air blast is the controlling damage-producing mechanism for destruction of field fortifications, including those reinforced, revetted or covered. Definitions of severe, moderate, and light damage levels to various types of field fortifications are given in table 7–4. These damage levels are based upon various degrees of collapse and structural failure except for unrevetted trenches and foxholes, which have damage levels based on degree of filling caused by collapse of the walls and by filling with dust and debris. Areas covered with loose material, such as sand and gravel, may provide sufficient dust and debris to completely fill a trench or foxhole, whereas areas with stable vegetation or areas of dry silty soil may not provide significant quantities of dust and debris to appreciably fill a trench or foxhole. Collapse of the walls of foxholes and trenches by air blast and air induced ground shock is usually not significant except at ranges less than those shown for severe damage in figure 7–22.

Table 7–4. Damage Criteria for Field Fortifications

Description	Severe
Unrevetted trenches and foxholes with or without light cover.	The trench or foxhole is at least 50 percent filled with earth.

FIGURES 7-20—7-22

The curves in figure 7–22 are based on results of tests run in a *consolidated dry sand and gravel soil*. Trenches and foxholes in damp soil with stable vegetation or dry silty soil will receive moderate and severe damage at ranges less than those shown in figure 7–22. The curves of figure 7–22 are for average rectangular foxholes with the longitudinal axis perpendicular to the direction of air blast propagation. Damage will be equal or less for other orientations.

Given: A 50 KT burst at an altitude of 1,000 feet.

Find: To what horizontal distance there is a 50 percent probability of severe damage to an unrevetted foxhole in a dry, consolidated sand and gravel soil.

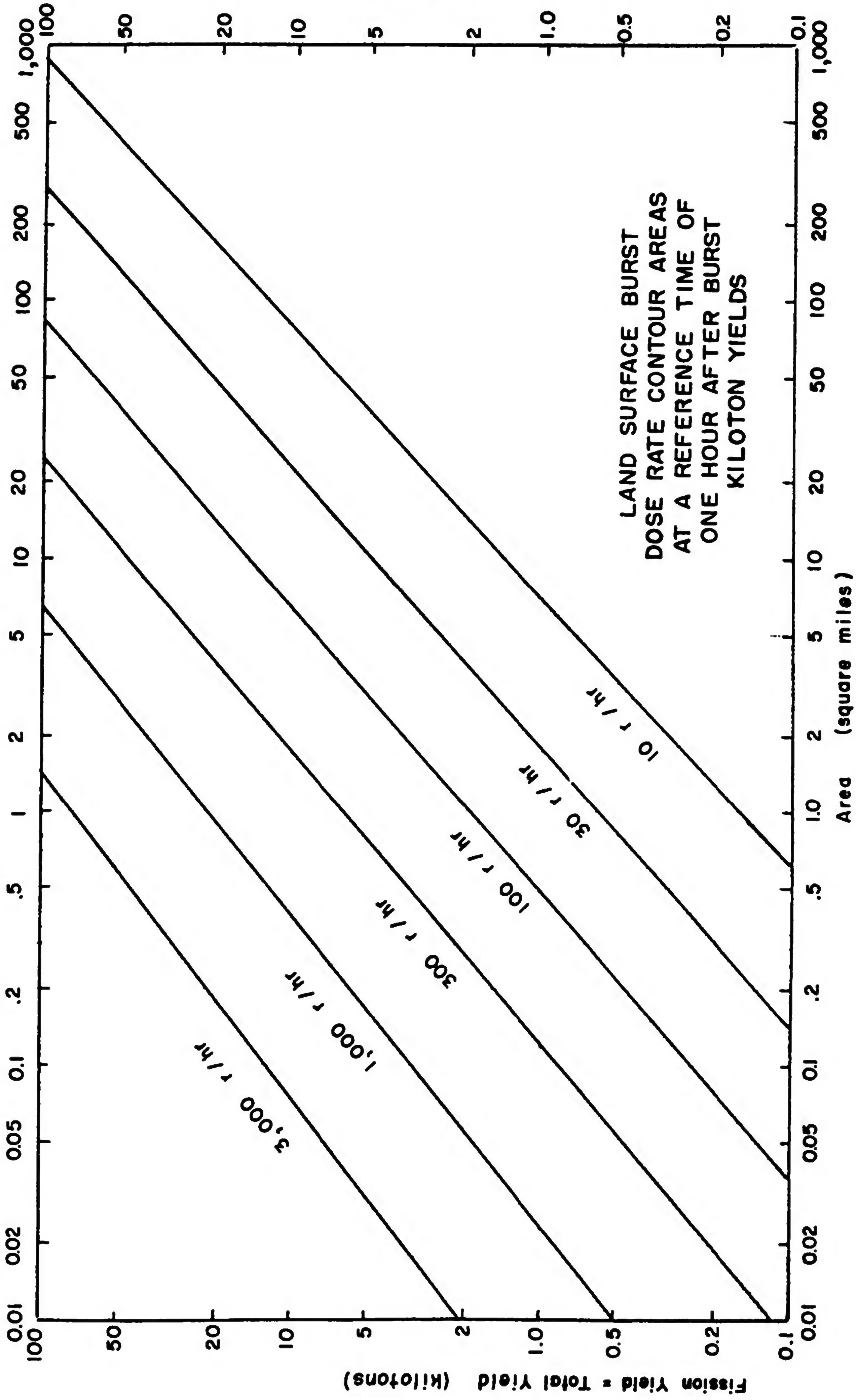
Solution: 680 yards.

Approximately 20 psi peak overpressure

Table 7–3. Damage Criteria for Underground Structures

Structure	Damage	Damage distance	Remarks
Relatively small, heavy, well designed underground targets.	Severe	$1\frac{1}{4}R_a$	Collapse.
	Light	$2R_a$	Slight cracking, severance of brittle external connections.
Relatively long, flexible targets, such as buried pipelines, tanks, etc.	Severe	$1\frac{1}{2}R_a$	Deformation and rupture.
	Moderate	$2R_a$	Slight deformation and rupture.
	Light	$2\frac{1}{2}$ to $3R_a$	Failure of connections. (Use higher value for radial orientation of connections.)

Note. R_a=Apparent Crater Radius.


LAND SURFACE BURST
DOSE RATE CONTOUR AREAS
AT A REFERENCE TIME OF
ONE HOUR AFTER BURST
KILOTON YIELDS
10 r / hr
30 r / hr
100 r / hr
300 r / hr
1,000 r / hr
3,000 r / hr
Area (square miles)
Fission Yield = Total Yield (kilotons)
0.01
0.02
0.05
0.1
.2
.5
1
2
5
10
20
50
100
200
500
1,000
0.1
0.2
0.5
1.0
2
5
10
20
50
100

DNA EM-1
PART I

DEFENSE NUCLEAR AGENCY EFFECTS MANUAL NUMBER 1

CAPABILITIES OF NUCLEAR WEAPONS

1 JULY 1972

HEADQUARTERS
Defense Nuclear Agency
Washington, D.C. 20305

FOREWORD

This edition of the *Capabilities of Nuclear Weapons* represents the continuing efforts by the Defense Nuclear Agency to correlate and make available nuclear weapons effects information obtained from nuclear weapons testing, small-scale experiments, laboratory effort and theoretical analysis. This document presents the phenomena and effects of a nuclear detonation and relates weapons effects manifestations in terms of damage to targets of military interest. It provides the source material and references needed for the preparation of operational and employment manuals by the Military Services.

The *Capabilities of Nuclear Weapons* is not intended to be used as an employment or design manual by itself, since more complete descriptions of phenomenological details should be obtained from the noted references. Every effort has been made to include the most current reliable data available on 31 December 1971 in order to assist the Armed Forces in meeting their particular requirements for operational and target analysis purposes.

Comments concerning this manual are invited and should be addressed:

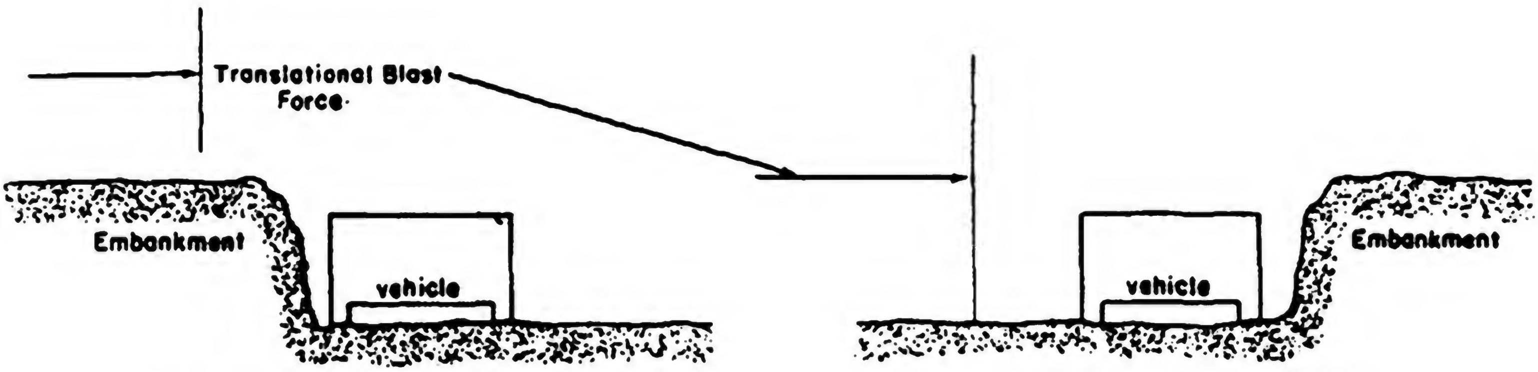
Director
Defense Nuclear Agency
ATTN: STAP
Washington, D. C. 20305

C. H. DUNN
Lt General, USA
Director

Table 10-1 Estimated Casualty Production in Buildings for Three Degrees of Structural Damage

Structural Damage	Percent of Personnel*		
	Killed Outright	Serious Injury (hospitalization)	Light Injury (no hospitalization)
1-2 story brick homes (high-explosive data from England):			
Severe damage	25	20	10
Moderate damage	<5	10	5
Light damage	–	<5	<5
Reinforced-concrete buildings (nuclear data from Japan):			
Severe damage	100	–	–
Moderate damage	10	15	20
Light damage	<5	<5	15

*These percentages do not include the casualties that may result from fires, asphyxiation, and other causes from failure to extricate trapped personnel. The numbers represent the estimated percentages of casualties expected at the maximum range where a specified structural damage occurs. See Chapter 11 for the distances at which these degrees of damage occur for various yields.



(a) No translation because Translational Force is not applied

(b) No or little translation because embankment restricts movement

Figure 14-8. The Effect of Shielding

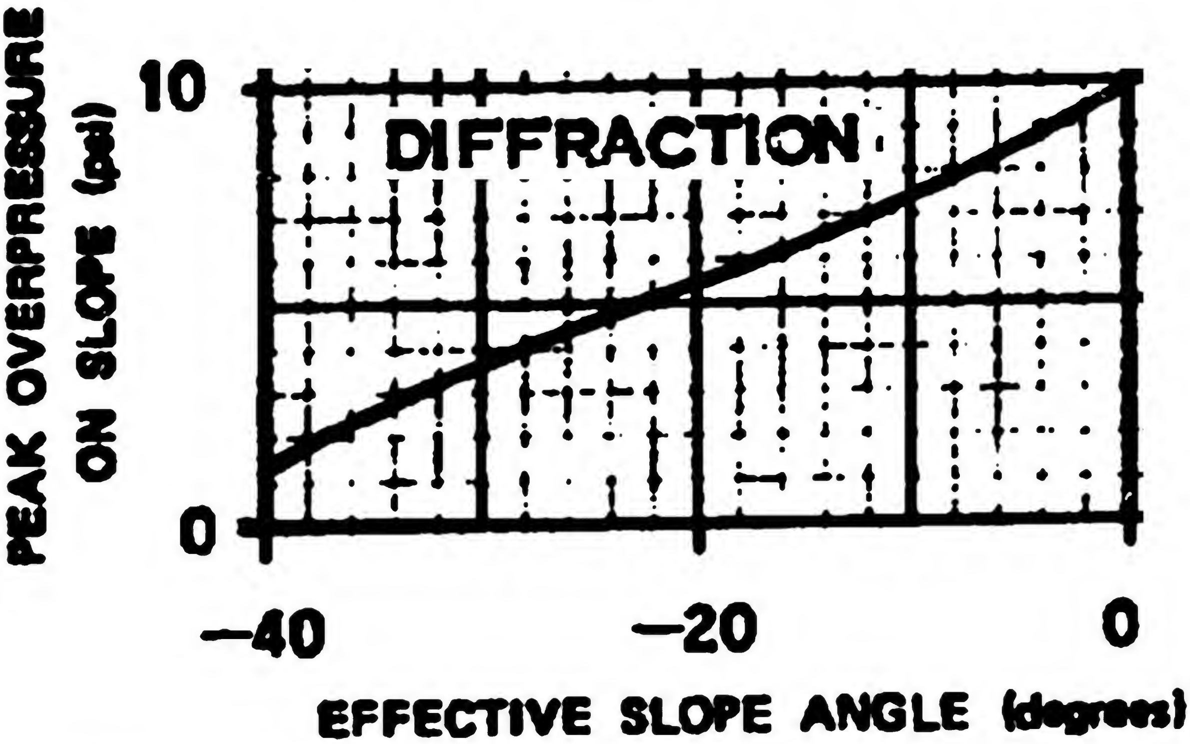


Figure 2-53. Peak Overpressure Produced on a Slope by a 10-psi Incident Mach Stem as a Function of a Slope Angle

If the pulse is of long duration, the ignition threshold rises because the exposed material can dissipate an appreciable fraction of the energy while it is being received. For very long rectangular pulses an irradiance of about 0.5 $cal \cdot cm^{-2} sec^{-1}$ is required to ignite the cellulose. Heat supplied to the material at a slow rate is just sufficient to offset radiative and convective heat losses, while maintaining the cellulose at the ignition temperature of about 300°C.

9-19

Most thick, dense materials that ordinarily are considered inflammable do not ignite to persistent flaming ignition when exposed to transient thermal radiation pulses. Wood, in the form of siding or beams, may flame during the exposure but the flame is extinguished when the exposure ceases.

9-25

MINISTRY OF HOME SECURITY

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FOREWORD

BY

SIR JOHN ANDERSON, G.C.B., G.C.S.I., G.C.I.E., M.P.

Minister of Home Security.

This book is written to help you and your family and your friends.

There has been built up in the last few years a vast organisation for Civil Defence; and, thanks to the devotion of a great army of volunteers, the services which it comprises have been welded into a highly efficient force. This organisation is briefly described in the first chapter, which has been included in this book for two reasons; first, because I may, in the near future, have to call on many of you to give some part of your time to one or other of these services, and secondly, because you may need the help of the services and should therefore understand something about them.

But the Civil Defence services alone cannot protect you from the consequences of air raids. Your own protection and the protection of your family must, in large measure, depend on your taking certain necessary precautions. You can yourself do much to minimise risk to yourself and to those dependent on you.

A great deal of information has been collected as a result of experience gained in actual air raids, and from this and from research and experiment the basic principles on which the protection of life and limb and property depends have been worked out and are set down here for your guidance. They are simple to understand and easy to carry out; and if you will act on them you will be able to face the dangers of air raids with the sure conviction that you have done all in your power for the safety of those depending on you, and with the calmness and assurance that come from a knowledge of the way in which these dangers can be met. In this way you will be helping not only yourself, but the Nation, for it is through the strengthening of your powers of resistance that the people of this country will be enabled to defeat every attempt the enemy may make to weaken its morale and paralyse its war effort.

In this war every man and woman is in the front line. A soldier at the front who neglects the proper protection of his trench does more than endanger his own life; he weakens a portion of his country's defences and betrays the trust which has been placed in him. You, too, will have betrayed your trust if you neglect to take the steps which it is your responsibility to take for the protection of yourself and your family.

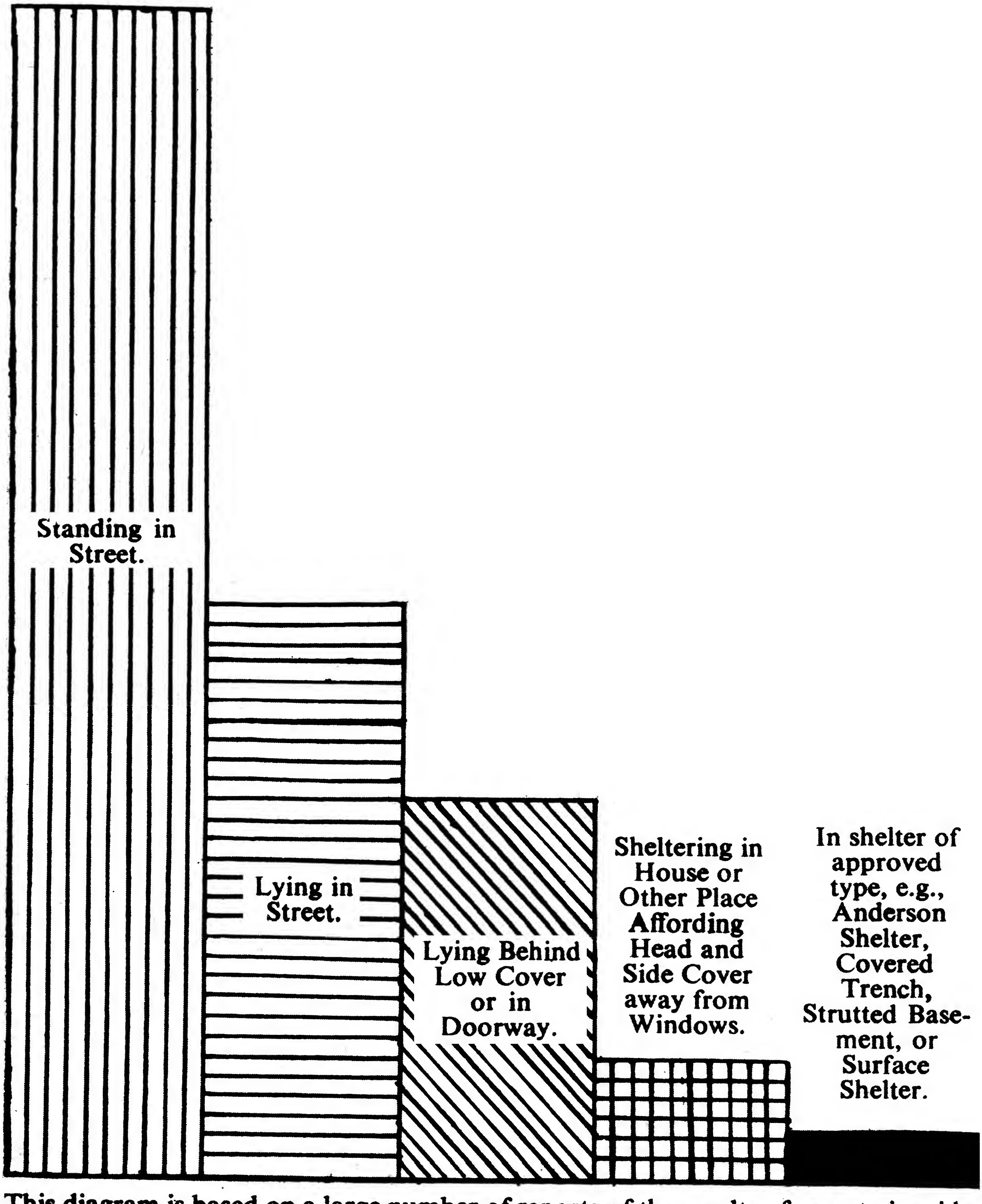
This is a contribution to the winning of final victory which you personally can make and which no one else can make for you. I am confident that you will make it.

Ministry of Home Security.

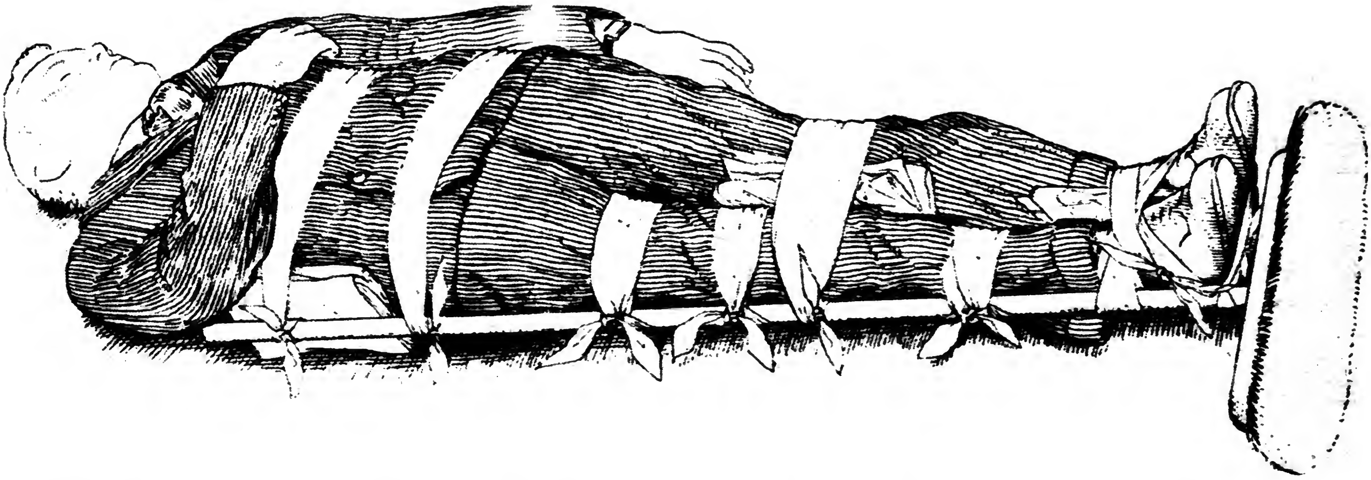
June, 1940.

Tools.

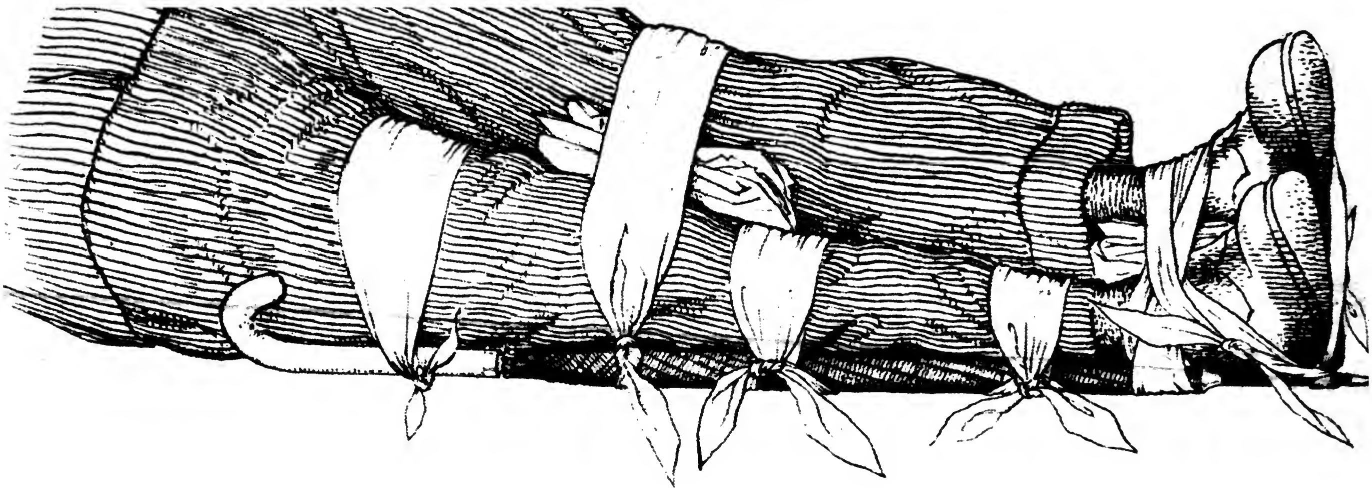
A number of tools such as picks, shovels, and crowbars should be kept in a shelter to be used in forcing a way out if the occupants are trapped. When the accommodation is being fitted out, it should be discovered where the weakest part of the structure is, or where it would be most suitable to work, should it become necessary to break a way out. This position should be clearly marked for the benefit of all.



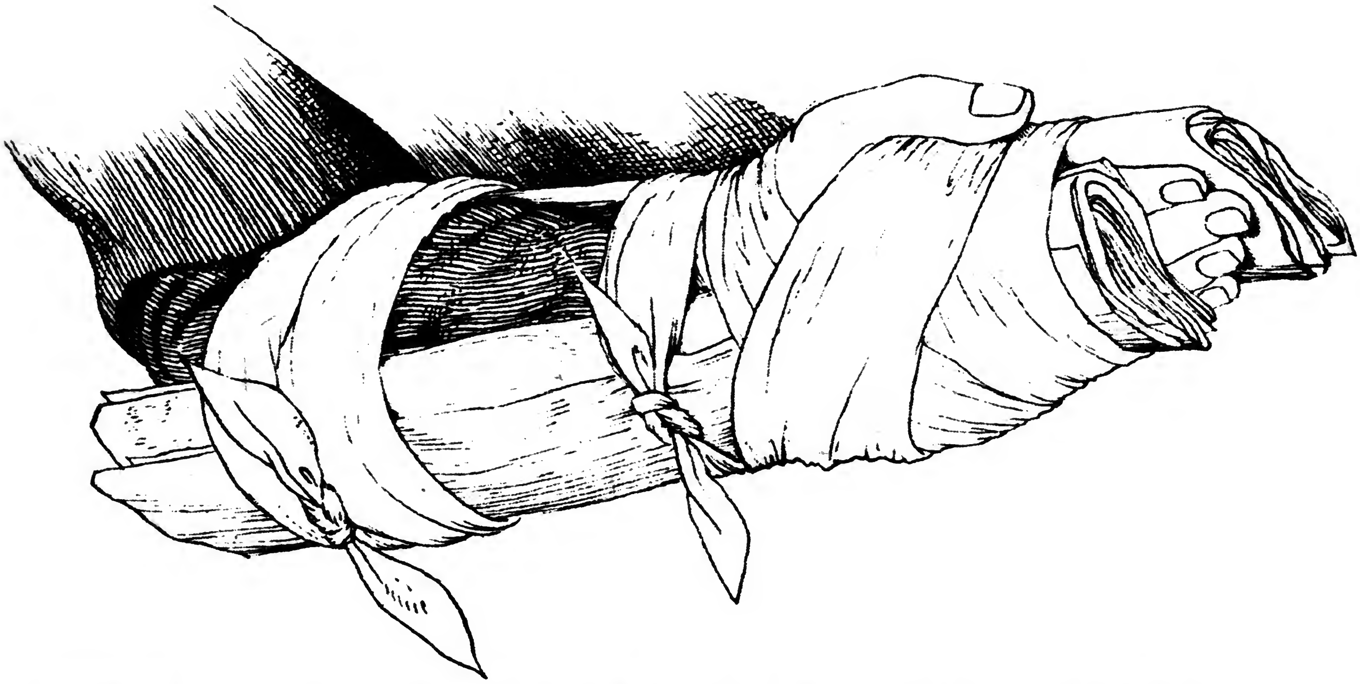
This diagram is based on a large number of reports of the results of recent air raids and is an approximate indication of the difference in the degree of risk resulting from taking cover in various ways.



A broom used as a thigh splint by placing the handle along the injured limb, with the head of the broom at the feet. Loosely folded pieces of newspaper or other material may be used as padding, placed between the ankle and knee joints, and also at the hip.



Sketch II.—Simple fracture through middle third of tibia (shin-bone).
The illustration shows an umbrella used as a splint. The ankles and knee joints are padded with loosely folded newspaper.



Sketch III. **Simple fracture through one or both bones of the forearm.**

The illustration shows the use of newspaper, folded to the approximate size of an arm splint, so as to be stiff enough to give rigid support.

AN ANALYSIS OF 259 OF THE RECENT FLYING-BOMB CASUALTIES

BY

R. C. BELL, M.B., M.R.C.S.

Resident Surgical Officer to an E.M.S. Hospital

In all we dealt with 222 out-patients and 259 in-patients, with 18 deaths. Our story began in June, 1944, when the first large incident occurred near by. Twenty-six casualties were admitted and 12 required theatre treatment. This proportion remained fairly constant throughout the series. Altogether we had 83 theatre cases out of 259 admissions, and had to send 35 cases on untreated, most of whom required the theatre. In this first incident no fewer than 16 of the casualties were due to flying glass. It was noticeable how the proportion of glass injuries dropped as the importance of taking adequate cover was realized, while the percentage of crush injuries increased from people being trapped by falling masonry.

A. Flying Glass

This was the most frequent cause of injury, totalling over 100 casualties in all. Many included severe damage to the eyes. It is noticeable that most of the injuries were above the nipple line, chiefly of the face and neck: a large proportion were received when looking out of windows—a modern version of curiosity killing the cat. We had five cases of perforating wounds of both eyes and ten perforating wounds of one eye. The globe was usually completely destroyed. Many of these injuries were avoidable, and therein lay their great sadness.

The penetrating power of flying glass is, in the main, low. It is unusual for it to pierce the deep fascia: usually it lies just under the skin in the fat, but when present in hundreds of pieces it presents a problem which has not yet acquired a satisfactory solution ; nor has the condition made its way into the textbooks of war surgery.

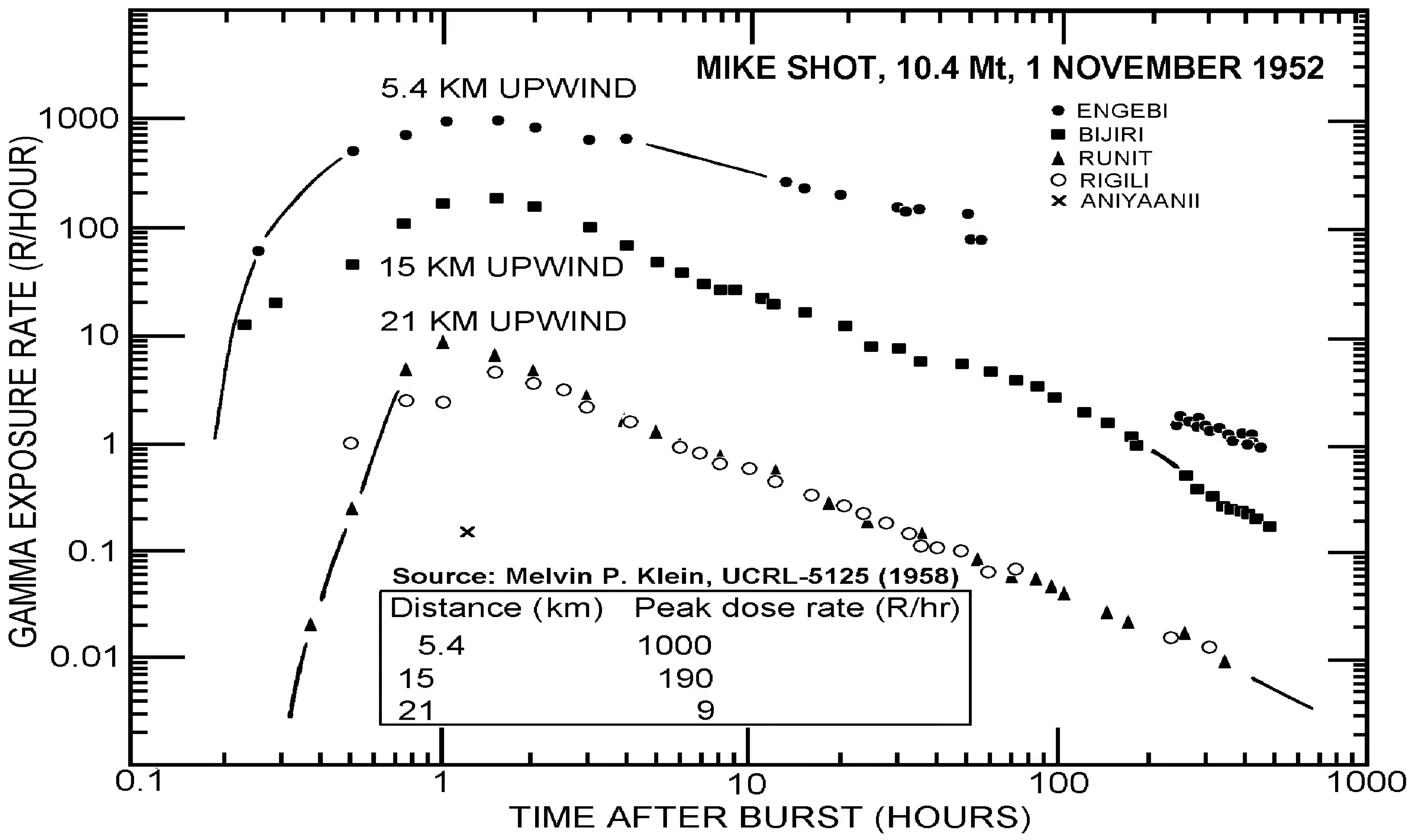
TABLE I.—*Glass*

Description	No.	Remarks	Deaths
Lacerations of face, scalp, and neck ..	77	19 T	—
Perforating wounds of eye	15	5 cases bilateral 2 T	—
Cut hands	9		
Severe multiple lacerations	6	1 T	1
Other injuries	5	—	—

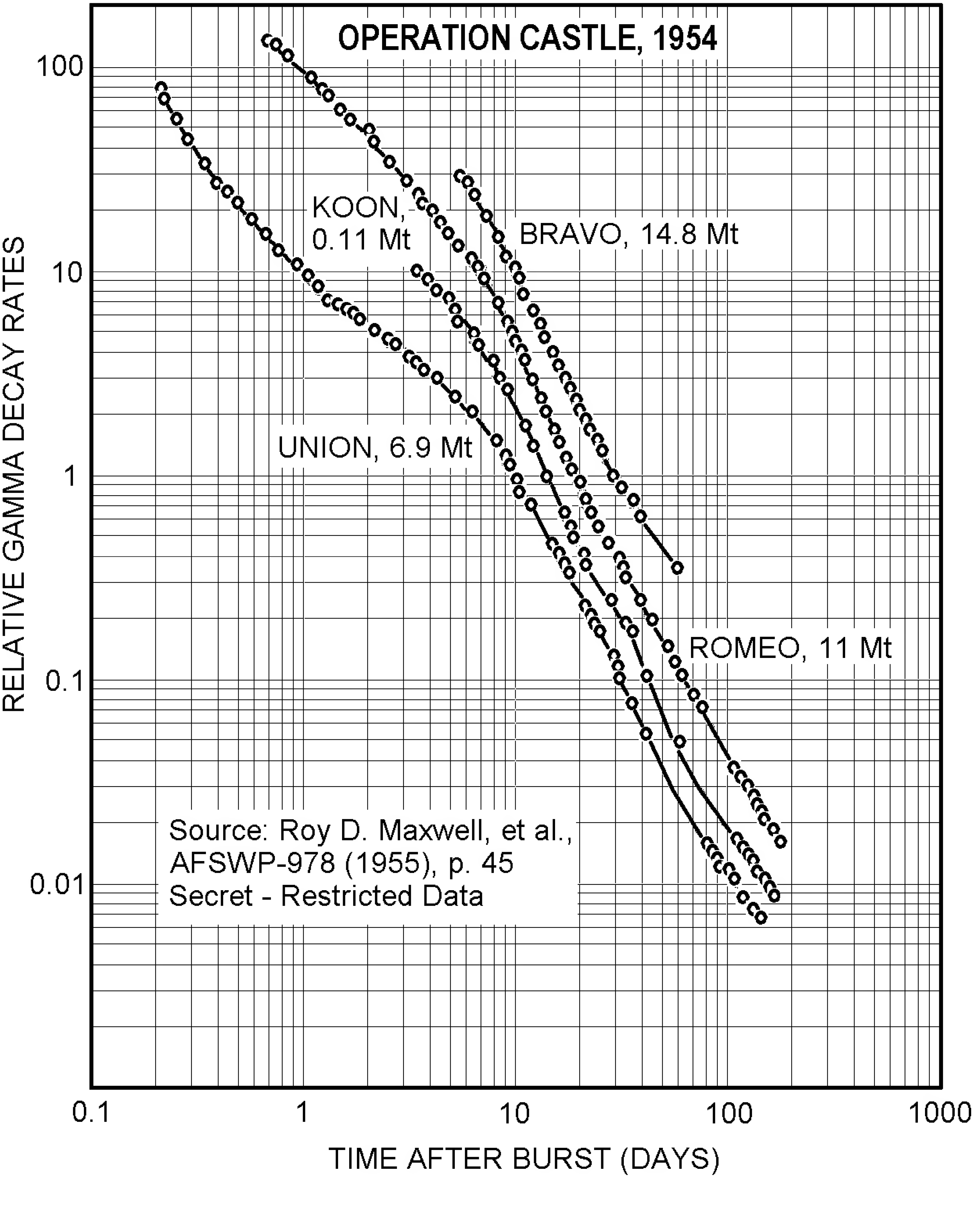
Number and Classification of Official Evacuees in Great Britain in 1939 and 1940

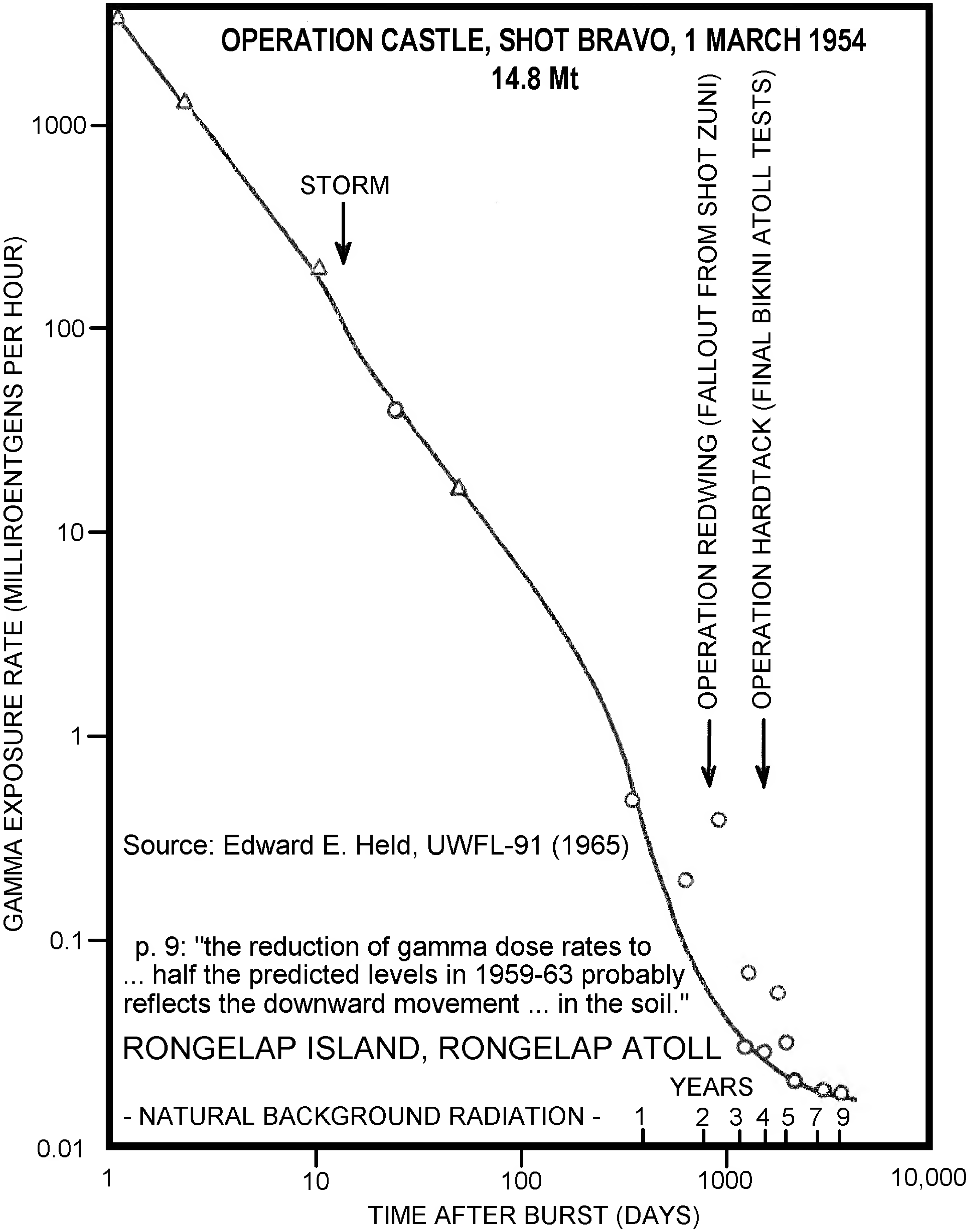
900,000 of the 1.5 million returned to the target areas after four months of war.	September, 1939		January, 1940	
	Number	Percentage Distribution	Number	Per cent of Those in September, 1939
1. Unaccompanied school children	826,959	56.1	457,600	55
2. Mothers and accompanied children	523,670	35.5	64,900	12
3. Expectant mothers	12,705	0.9	1,140	9
4. Blind persons, cripples, and other special classes	7,057	0.5	2,440	35
5. Teachers and helpers	103,000	7.0	46,500	45
Total	1,473,391	100.0	572,580	39

Source: R. M. Titmuss, *Problems of Social Policy* (London: H.M. Stationery Office, 1950), pp. 103 and 172.

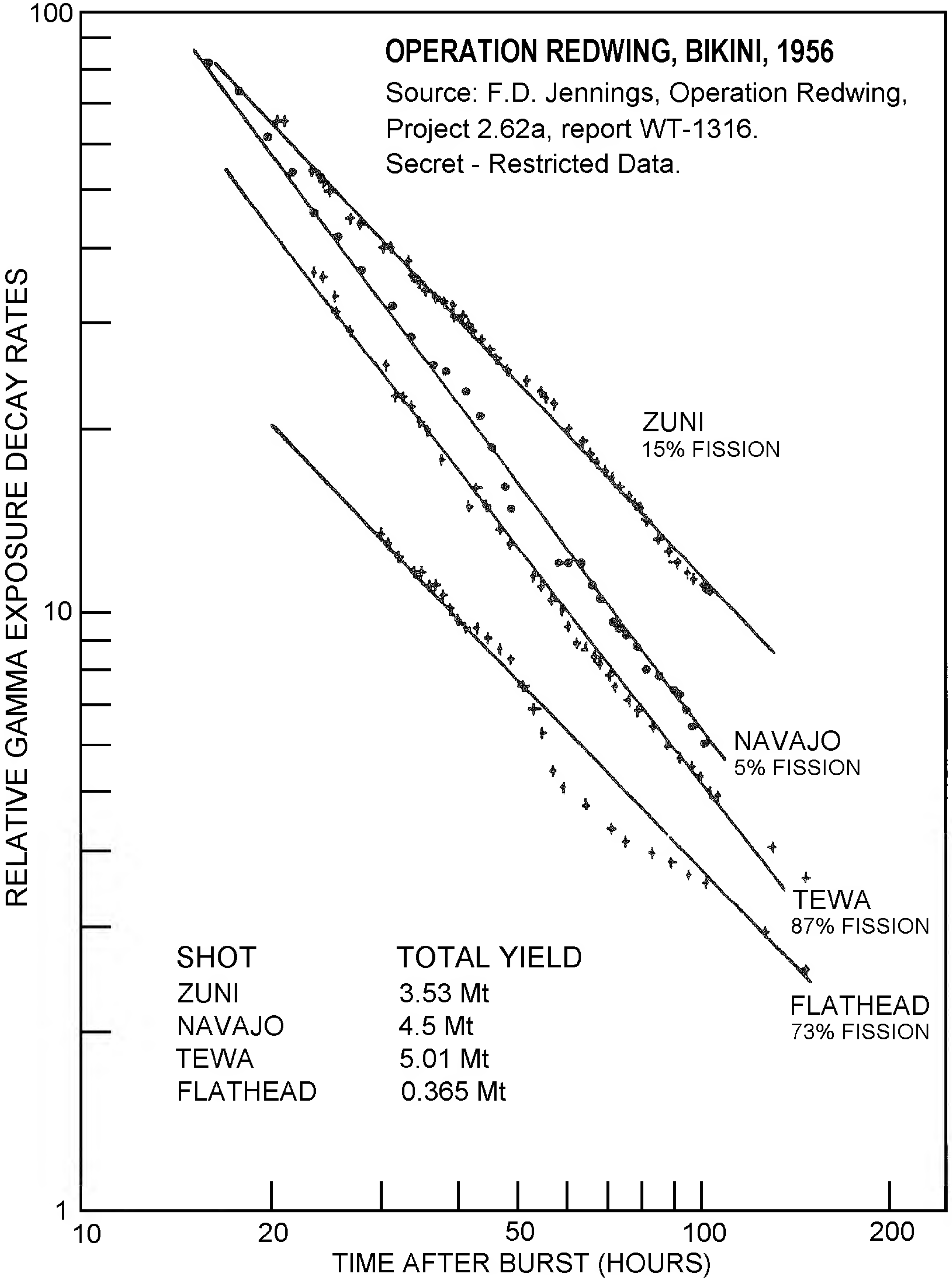


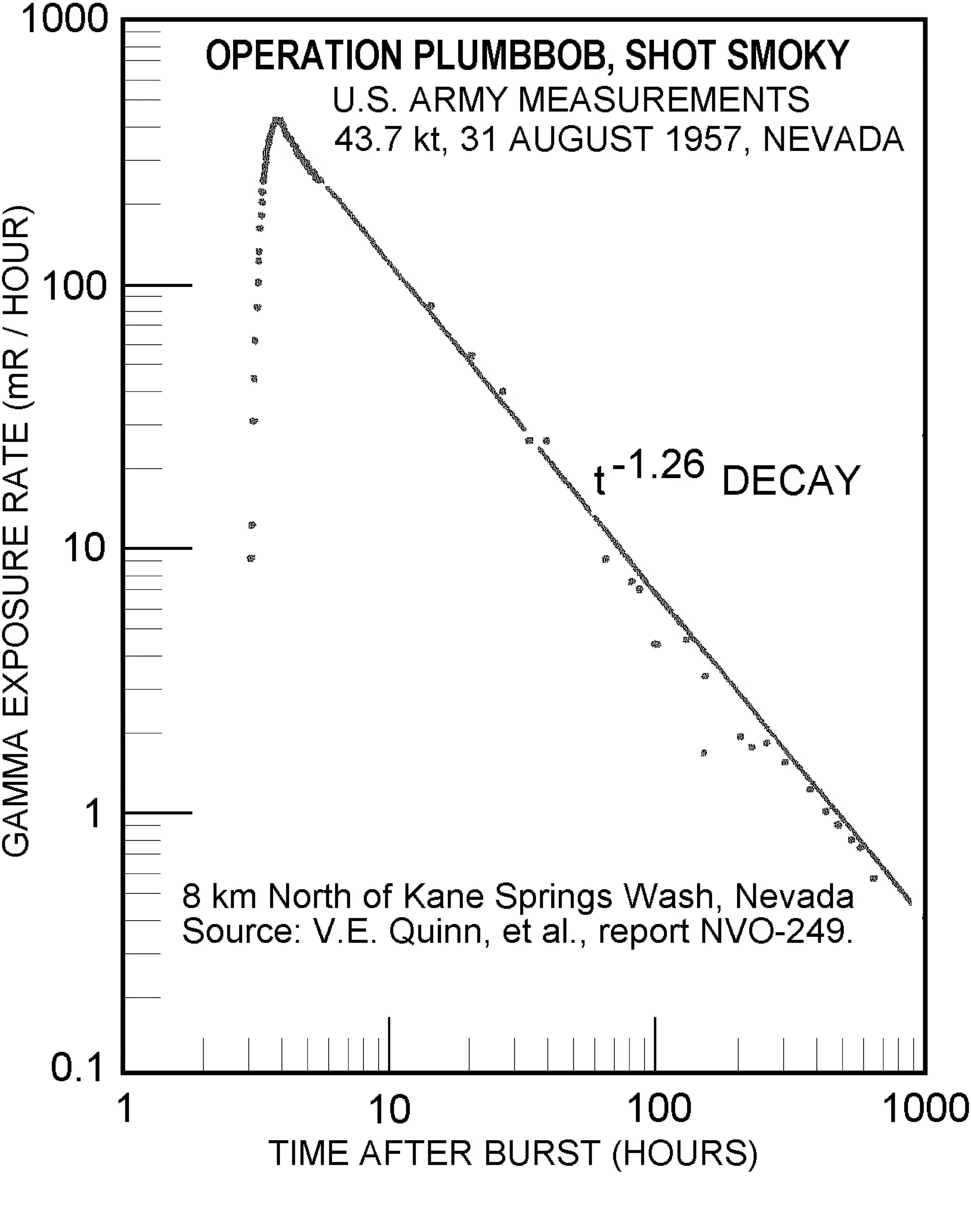
MIKE SHOT, 10.4 Mt, 1 NOVEMBER 1952
5.4 KM UPWIND
15 KM UPWIND
21 KM UPWIND
ENGEBI
BIJIRI
RUNIT
RIGILI
ANIYAANII
Source: Melvin P. Klein, UCRL-5125 (1958)
Distance (km) Peak dose rate (R/hr)
5.4 1000
15 190
21 9
GAMMA EXPOSURE RATE (R/HOUR)
1000
100
10
1
0.1
0.01
0.1
1
10
100
1000
TIME AFTER BURST (HOURS)


OPERATION CASTLE, 1954
KOON, 0.11 Mt
BRAVO, 14.8 Mt
UNION, 6.9 Mt
ROMEO, 11 Mt
Source: Roy D. Maxwell, et al., AFSWP-978 (1955), p. 45 Secret - Restricted Data
RELATIVE GAMMA DECAY RATES
100
10
1
0.1
0.01
0.1
1
10
100
1000
TIME AFTER BURST (DAYS)



OPERATION CASTLE, SHOT BRAVO, 1 MARCH 1954
14.8 Mt
STORM
OPERATION REDWING (FALLOUT FROM SHOT ZUNI)
OPERATION HARDTACK (FINAL BIKINI ATOLL TESTS)
Source: Edward E. Held, UWFL-91 (1965)
p. 9: "the reduction of gamma dose rates to ... half the predicted levels in 1959-63 probably reflects the downward movement ... in the soil."
RONGELAP ISLAND, RONGELAP ATOLL
YEARS
- NATURAL BACKGROUND RADIATION -
1 2 3 4 5 7 9
GAMMA EXPOSURE RATE (MILLIROENTGENS PER HOUR)
1000
100
10
1
0.1
0.01
1
10
100
1000
10,000
TIME AFTER BURST (DAYS)


OPERATION REDWING, BIKINI, 1956
Source: F.D. Jennings, Operation Redwing, Project 2.62a, report WT-1316. Secret - Restricted Data.
ZUNI
15% FISSION
NAVAJO
5% FISSION
TEWA
87% FISSION
FLATHEAD
73% FISSION
SHOT
TOTAL YIELD
ZUNI
3.53 Mt
NAVAJO
4.5 Mt
TEWA
5.01 Mt
FLATHEAD
0.365 Mt
RELATIVE GAMMA EXPOSURE DECAY RATES
100
10
1
10
20
50
100
200
TIME AFTER BURST (HOURS)


OPERATION PLUMBBOB, SHOT SMOKY
U.S. ARMY MEASUREMENTS
43.7 kt, 31 AUGUST 1957, NEVADA
$t^{-1.26}$ DECAY
8 km North of Kane Springs Wash, Nevada
Source: V.E. Quinn, et al., report NVO-249.
GAMMA EXPOSURE RATE (mR / HOUR)
TIME AFTER BURST (HOURS)
1000
100
10
1
0.1
1
10
100
1000

C00012335

CENTRAL INTELLIGENCE AGENCY
WASHINGTON 25, D. C.

CIA 12 March 1962

12 MAR 1962

MEMORANDUM FOR: The Director of Central Intelligence

SUBJECT : MILITARY THOUGHT: "Some Factors Affecting the Planning of a Modern Offensive Operation", by Colonel-General Ye. Ivanov

1. Enclosed is a verbatim translation of an article which appeared in the TOP SECRET Special Collection of Articles of the Journal "Military Thought" ("Voyennaya Mysl") published by the Ministry of Defense, USSR, and distributed down to the level of Army Commander.

2. In the interests of protecting our source, this material should be handled on a need-to-know basis within your office. Requests for extra copies of this report or for utilization of any part of this document in any other form should be addressed to the originating office.

Richard Helms

Richard Helms
Deputy Director (Plans)

Following is a verbatim translation of an article titled "Some Factors Affecting the Planning of a Modern Offensive Operation", written by Colonel-General Ye. Ivanov.

This article appeared in the 1960 Second Issue of a special version of Voyennaya Mysl (Military Thought) which is classified TOP SECRET by the Soviets and is issued irregularly.

* * *

Weakening the nuclear strength of an opposing grouping of the enemy and depriving him of his capability to use nuclear weapons is one of the most important tasks, whose correct solution ensures the success of the offensive operation as a whole.

* * *

The mass utilization of nuclear weapons in short periods of time is the only way to achieve decisive destruction of the fire power of an opposing enemy grouping, destruction of his main nuclear/missile and aviation means, and also disruption of the control of troops and the disorganization of work of the rear services.

U.K. National Archives:

SECRET

Extracts from Khrushchev's letter to Kennedy, 26 October 1962 (Catalogue ref: PREM 11/3691)

QUOTE

Dear Mr. President:

I have received your letter of October 25. From your letter, I got the feeling that you have some understanding of the situation which has developed and (some) sense of responsibility. I value this.

Now we have already publicly exchanged our evaluations of the events around Cuba and each of us has set forth his explanation and his understanding of these events. Consequently, I would judge that, apparently, a continuation of an exchange of opinions at such a distance, even in the form of secret letters, will hardly add anything to that which one side has already said to the other.

I think you will understand me correctly if you are really concerned about the welfare of the world. Everyone needs peace: Both capitalists, if they have not lost their reason, and still more, Communists, people who know how to value not only their own lives but, more than anything, the lives of the people. We, Communists, are against all wars between states in general and have been defending the cause of peace since we came into the world. We have always regarded war as a calamity, and not as a game nor as a means for the attainment of definite goals, nor, all the more, as a goal in itself. Our goals are clear, and the means to attain them is labor. War is our enemy and a calamity for all the peoples.

It is thus that we, Soviet people, and, together with us, other peoples as well, understand the questions of war and peace. I can, in any case, firmly say this for the peoples of the Socialist countries, as well as for all progressive people who want peace, happiness, and friendship among peoples.

I see, Mr. President, that you too are not devoid of a sense of anxiety for the fate of the world, of understanding, and of what war entails. What would a war give you? You are threatening us with war. But you well know that the very least which you would receive in reply would be that you would experience the same consequences as those which you sent us. And that must be clear to us, people invested with authority, trust, and responsibility. We must not succumb to intoxication and petty passions, regardless of whether elections are impending in this or that country, or not impending. These are all transient things, but if indeed war should break out, then it would not be in our power to stop it, for such is the logic of war. I have

participated in two wars and know that war ends when it has rolled through cities and villages, everywhere sowing death and destruction.

In the name of the Soviet Government and the Soviet people, I assure you that your conclusions regarding offensive weapons on Cuba are groundless. It is apparent from what you have written me that our conceptions are different on this score, or rather, we have different estimates of these or those military means. Indeed, in reality, the same forms of weapons can have different interpretations.

You are a military man and, I hope, will understand me. Let us take for example a simple cannon. What sort of means is this: offensive or defensive? A cannon is a defensive means if it is set up to defend boundaries or a fortified area. But if one concentrates artillery, and adds to it the necessary number of troops. Then the same cannons do become an offensive means, because they prepare and clear the way for infantry to attack. The same happens with missile - nuclear weapons as well, with any type of this weapon.

You are mistaken if you think that any of our means on Cuba are offensive. However, let us not quarrel now. It is apparent that I will not be able to convince you of this. But I say to you: You, Mr. President, are a military man and should understand: Can one attack, if one has on one's territory even an enormous quantity of missiles of various effective radiuses and various power, but using only these means? These missiles are a means of extermination and destruction. But one cannot attack with these missiles, even nuclear missiles of a power of 100 megatons because only people, troops, can attack. Without people, any means however powerful cannot be offensive.

Armaments bring only disasters. When one accumulates them, this damages the economy, and if one puts them to use, then they destroy people on both sides. Consequently, only a madman can believe that armaments are the principal means in the life of society. No, they are an enforced loss of human energy, and what is more are for the destruction of man himself. If people do not show wisdom, then in the final analysis they will come to a clash, like blind moles, and then reciprocal extermination will begin.

Let us therefore show statesmanlike wisdom. I propose: We, for our part, will declare that our ships, bound for Cuba, will not carry any kind of armaments. You would declare that the United States will not invade Cuba with its forces and will not support any sort of forces which might intend to carry out an invasion of Cuba. Then the necessity for the presence of our military specialists in Cuba would disappear.

'PEACE' OF THE DEAD

1986 CND "mole"
(infiltrator) Paul
Mercer exposed
USSR propaganda

Paul Mercer

Foreword by Lord Chalfont, OBE, MC, PC

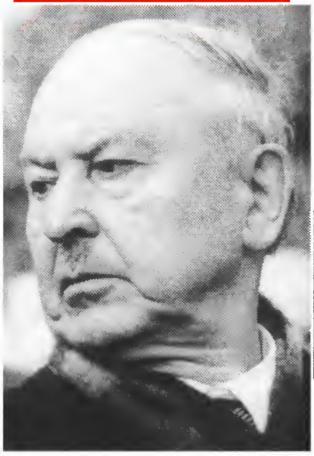
"I personally need no lessons on how to combat 'anti-Sovietism' in the peace movement from armchair peace campaigners. The consistent stand of CND for unilateral nuclear disarmament and withdrawal from NATO has been won by working as Communists in a principled non-sectarian way."—CND Vice-President, John Cox *Morning Star*, 8 January 1985

Paul Mercer, who graduated from Nottingham University in 1982, is a political research consultant and author of several specialist books on military aviation.

The author (*left*) with one of his 'sources', Mgr Bruce Kent—former General Secretary of the Campaign for Nuclear Disarmament.

"I don't condemn the IRA bombings in public—I explain that they are a direct response to British policy—in some situations it's not useful to preach pacifism."—CND Council Member, Pat Arrowsmith *Socialist Challenge*, 4 June 1982

POLITBURO
BORIS PONOMAREV



POLITBURO
BORIS PONOMAREV
(Candidate member)

↓

CENTRAL COMMITTEE
OF THE SOVIET COMMUNIST PARTY
BORIS PONOMAREV
(Secretary)

↓

INTERNATIONAL DEPARTMENT
BORIS PONOMAREV
(Head)
OLEG KHARKHARDIN
(Vice-President of Soviet Peace Committee)

↓

WORLD PEACE COUNCIL
ROMESH CHANDRA
(President)
OLEG KHARKHARDIN
(Vice-President of Soviet Peace Committee)

↓

INTERNATIONAL LIAISON FORUM OF PEACE FORCES
ROMESH CHANDRA
(Chairman)
OLEG KHARKHARDIN
(Executive Secretary)
ARTHUR BOOTH
(Vice-Chairman)
SEAN MacBRIDE
(Vice-Chairman)

(member body)

INTERNATIONAL PEACE BUREAU
ARTHUR BOOTH
(Chairman)
SEAN MacBRIDE
(President)
BRUCE KENT
(Vice-President)

(member body)

CAMPAIGN FOR NUCLEAR DISARMAMENT
BRUCE KENT
(General Secretary)
SEAN MacBRIDE
(Irish CND Committee)

CND
BRUCE KENT

World Peace Council President Romesh Chandra, Lenin Peace Prize winner:

"There is a wrong idea that détente means lessening the struggle ... détente means the intensification of the struggle ..."

- Sunday Chronicle, 19 December 1976

One of the CND's many links with the World Peace Council in 1983

Sean MacBride is a former IRA Commander awarded a Lenin Peace Prize and a Nobel

Boris Ponomarev, Politburo

(b 1905, Red Army 1919, Central C. 1956, Politburo 1972)

Head of the International Department, CCCP

Propagandarist inventor of détente appeasement

Boris Ponomarev was author of the books "The Great Vital Force of Leninism" and "The Liberation Movement", both Russian propaganda publications sent directly by the International Department of the Politburo to the British National Union of Teachers (NUT) as direct infiltration of Britain's schools. (Sources: John Izbicki, Daily Telegraph, 18 May 1981; Pincher, "The Secret Offensive") Result: NUT's "Teachers for Peace" anti-nuclear lobby for pro-détente school fiction, like "Z for Zachariah".

HOW MOTHERS LIKE ME ARE DRIVEN TO JOIN THE BIG PEACE DEMOS

The Cruise missile . . . target for CND fairytales. And (right) a concerned mother on the march.

This CND blackmail at our school gates . . .

by ANN LESLIE

SO were you there on October 22 ? Were you one of the huge crowd of 250,000 demonstrators thronging Hyde Park ?

And if you were not there, did you feel a little bit guilty about it ? Did some of that magnificent pre-rally CND propaganda get to you ?

Because it was indeed powerful. propaganda. On Friday morning, the day before the demos, I and other mothers were delivering our tiny sons and daughters to their North London primary school.

This humdrum, happy, chattering little scene in the sunshine was briefly overshadowed by a sudden glimpse of apocalyptic terror in the form of two leaflets handed out to us at the gates.

Horrors

The first said: 'October 22. Where will you be ?' The second, from the Camden Labour Party, told us why we should be there on Saturday. Cruise missiles, due to be installed in December, will 'make nuclear war more likely. . . .'

And just in case we mothers were to preoccupied juggling with push-chairs and shopping-bags to understand the implications of that, the leaflets told us what would happen if a one megaton bomb was exploded over Trafalgar Square.

We live in the 'area north of London Zoo up to Hampstead Heath' and that would mean, among other horrors, '50 per cent. dead from blast (ruptured guts, crushed bones).'

It didn't of course mention that the Soviets already have over 350 SS20s installed, each with three warheads, two-thirds of which are targeted on Western Europe. Information like that might 'confuse' us mothers outside the school gates.

Nor did it mention that most members of unofficial peace groups in Eastern Europe — those not controlled for propaganda purposes by the Soviet authorities — are bitterly opposed to the unilateralist and neutralist ideas of CND.

These Eastern Europeans know the realities of Soviet power, and they know that the West can only hope to succeed in disarmament negotiations if it negotiates from a position of strength.

The message handed out at the school gates had to be kept 'unconfused' by such 'irrelevant' facts.

And so, yes, those leaflets did have a powerful emotional kick. As I watched my adored little five-year-old cheerfully hurrying into class with her best friend, I felt a sudden lurch in my stomach.

Those two merry little souls, millions of innocents like them — 'ruptured guts, crushed bones'. Please God, no !

Declined

So why didn't I join that march on Saturday ? Don't I care ?

Well, it so happens that I was there—not as a demonstrator but as an observer. I was making a film report for Channel 4 on the demonstration which CND now claims is 'proof' that the peace movement has not lost its battle.

I had assumed that everyone in that crowd on Saturday actually knew what they were demonstrating about. But did they ?

Oh sure, they were, as everyone told me earnestly, demonstrating 'in favour of peace and against nuclear war'. Well, you'd have to be criminally insane not to be in favour of peace and against nuclear war. So let's try to take it beyond the infants' class level.

No use pointing out that public opinion as expressed by the people of Hungary, East Germany, Czechoslovakia, Poland and Afghanistan has only influenced the Kremlin into greater spasms of repression and cruelty.

Destroy

Presumably most of those at the demonstration were convinced by CND's propaganda

Nor is there any illusion at NATO or SHAPE headquarters (where last week I sat through many discussions with men with titles like Head of Nuclear Planning) that America could fight a limited nuclear war in Europe.

As General Rogers, the American Supreme Allied Commander, Europe, said: 'The Soviets have said that any American weapon system being fired at Soviet soil will be cause for her to attack the United States with strategic weapons.'

How many of the people in that crowd of 250,000 have been told any of this by CND ? Very few.

Alas, some of them didn't even seem to know the difference between 'unilateralist' and 'multilateralist'. One nice, earnest young man told me he was there because he was a 'multilateralist'.

Outbreak

But this, I pointed out, was a demonstration in favour of 'unilateralism'. His response was a look of utter bafflement.

Many in the crowd used the demonstration to promote a whole variety of separate causes. Like the seller of the Hard-Left newspaper who told me we must 'defend the Soviet Union against Western imperialism.'

Like those who wanted solar heating in homes. Like the Hare Krishna people who said that meat-eating was the cause of nuclear war.

And like the Greenham women, who were collecting money to finance a 'permanent' peace headquarters.

Not so long ago, they were telling me that the arrival of the first Cruise missile would mean the outbreak of nuclear Armageddon. Since the end of the world is nigh in a few weeks, it seemed odd, to say the least, to ask for money to set up a 'permanent' headquarters.

So all of you who might have felt a twinge of guilt about not 'being there on October 22' — forget it. The majority of those who were there were well-meaning, hopelessly muddled, easily exploited people

1983 Daily Mail

This battle for your child's mind

by Rodney Tyler

The fact is that most parents, throughout the country, would be horrified if they realised how, even in the basic routine subjects, such as English, History and Science, their sons and daughters are being indoctrinated.

Take a look at the methods employed in sample lessons in at least one school:

An English lesson is based on how the language of the nuclear age is used by the media to condition ordinary people into accepting Cruise missiles.

Then the teacher takes a headline from the sports pages: 'Hammers massacre Coventry in five-goal blitz.' He uses it as the starting point for a discussion which moves on to deplore the way newspapers and TV glory in war and distort the views of those who believe in peace.

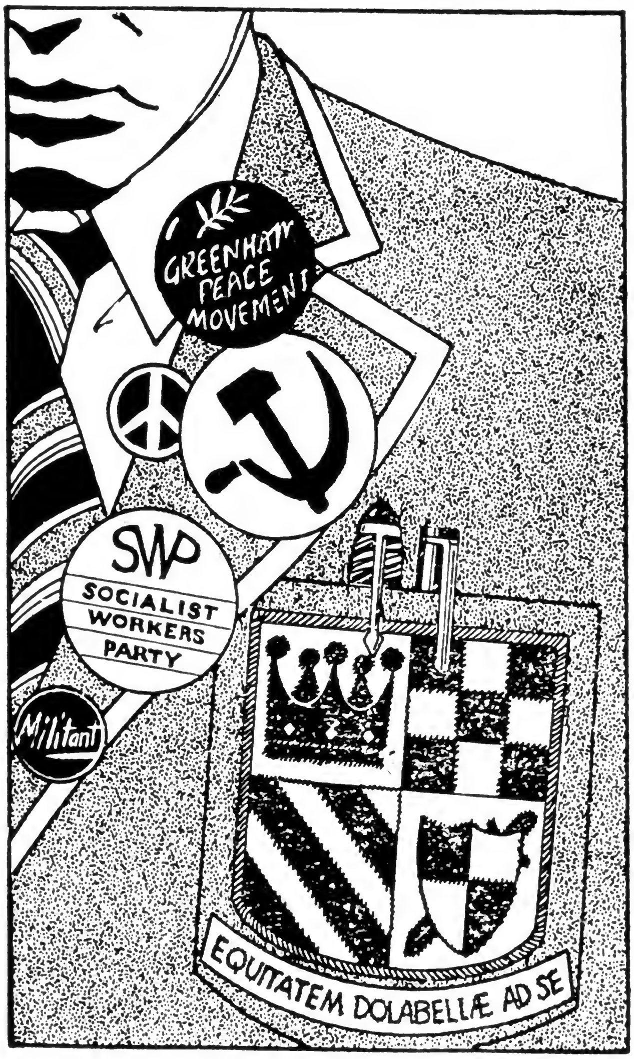
Science, before lunch, is easier. The Physics master, in defiance of a request from the Minister of Education, gives the pupils the full benefit of his personal conviction that American possession of a nuclear arsenal is a one-way suicide trip for mankind.

History, in the afternoon, is a study, through books supplied to the school by Novosti, the Soviet Press agency, of Russia's peaceloving intentions over the last 30 years, compared with Western war-mongering.

A fantasy? Not the sort of school you would dream of letting your child attend?

No It is fact. And you might soon have no choice but to send your child to such a school.

For there is at least one comprehensive school in Britain where each one of these sample lessons—or ones similar—has already taken place. And there are at least a dozen major local



In Britain's biggest teachers' union, the National Union of Teachers, more than 10 per cent. of delegates at the annual conferences come from just one of the extreme Left-Wing groups operating within the educational system.

But what he feared most of all was the attempt by the notorious Inner London Education Authority to foist on him those that were politically in line with its far-left leadership.

This school year he will be ordered to give more status to

released for special courses in how to combat racism.

Another London head described a visit from one of the proliferating 'advisers' who demanded to know why Irish politics, history, literature, and music were not being taught to the Irish children in his school.

The visitor accused him of 'not co-operating' when he pointed out that he had 30 different nationalities in the school and if he discriminated in favour of one minority he would have to favour them all.

But he sees as far more sinister the question he and ILEA's 170 comprehensive heads were forced to answer recently: 'Do you recognise the role of the "hidden Curriculum" in political education?'

He told me: 'It was rather like being asked if I had stopped beating my wife. If I said yes it would have meant that I was secretly indoctrinating my children, if I said no it meant I was refusing to do so. Either way I would be open to attack.'

The hidden curriculum is another way, in Left-Wing eyes, of influencing children. Put bluntly, it means taking every opportunity as it arises in normal lessons to put across your political message.

It is this sinister move, which ILEA—Britain's biggest authority—is poised to introduce. Thus, both overtly and covertly they plan a massive programme of indoctrination.

Printed advice on how to get rid of uncooperative heads which circulates secretly among some of these groups includes such gems as:

- Hold sudden meetings at the most difficult times for the head and his staff.
- Prolong meetings unnecessarily and harass officials of the Board into resignation — then put your own people into their positions

CND: IS IT ALL A RUSSIAN CON TRICK?

Moscow's making fools of our ban the bomb brigade

By MARJORY DAVIDSON

THE 19 Very Important Visitors were welcomed to Moscow in the style of Heads of State.

Police escorted their motorcade as it swept through red lights on the way from Sheremitovo Airport to a downtown hotel.

Visits to the Bolshoi Ballet, the old Czarist capital, Leningrad and the fabled cities of Tashkent and Samarkand were on the programme.

And it was red carpet treatment all the way.

The cost of this 10 day jaunt? Nothing—save the £190 cut-price air fare from London.

Who were the lucky 19? Not pop stars, or soccer players or even astronauts.

They were members of the Campaign for Nuclear Disarmament and fellow sympathisers.

Lord Brockway, co-chairman of the World Disarmament Campaign, led the party which included respected pacifists Dr Malcolm Dando, of Bradford University's School of Peace Studies, Richard Keeble, editor of The Teacher, and Father Owen Hardwicke, of Pax Christi, the Roman Catholic Disarmament lobby.

They had come to Moscow to talk peace.

But like the hundreds of thousands of ban-the-bomb marchers throughout Europe, they were and are, tragically, just dupes.

They are part of a campaign that is orchestrated and financed by the Soviet Union with the direct purpose of weakening the West, her resolve and her strength, while Russia continues to build up the most fearsome military machine in history.

Take that starry-eyed journey last March. The Russians quickly showed their visitors that they wanted others to talk about peace. They want others to disarm.

The naive band of travellers were campaigning for Britain to scrap all nuclear weapons. When they hesitantly asked the Kremlin to make a possible ten per cent reduction in its nuclear arsenal, the reply was a brutal "Niet."

In Britain, the ban-the-bomb campaign is booming. Membership has increased from 3,000 to 37,000 in 18 months and includes many idealistic young people.

Last October, more than 150,000 people from all over Britain attended the biggest demonstration in London since the heady days of the Sixties.

Brezhnev flew from Moscow to meet the 1,000 Soviet-subsidised delegates in Sofia.

Labour MPs present included Roy Hughes (Newport), James Lamond (Oldham East), Andrew Bennett (Stockport North), William Wilson (Coventry SE) and Alf Lomas (Euro MP London NE).

Alex Kitson, executive officer of the Transport and General Workers' Union, was also among the guests.

In Britain, as CND membership has grown, a Left-wing takeover has emer... the top.

Idealists have been replaced by militants with potent Euro-Communist connections.

They seek a power base in Britain. They aim to get it by exploiting the fear and horror felt by decent men and women at the idea of nuclear war.

They have formed special sections — Youth CND and Christian CND —to extend their sphere of influence.

They are especially active in trying to persuade trade unions to affiliate to CND.

These are the facts to remember when next you are impressed by ... lowers on the march— Moscow-style.

LEFTIES WHO RUN PEACE CAMPAIGN

September 30, 1938 peace promise:

We, the German Führer and Chancellor and the British Prime Minister, have had a further meeting today and are agreed in recognising that the question of Anglo-German relations is of the first importance for the two countries and for Europe.

We regard the agreement signed last night and the Anglo-German Naval Agreement as symbolic of the desire of our two peoples never to go to war with one another again.

We are resolved that the method of consultation shall be the method adopted to deal with any other questions that may concern our two countries, and we are determined to continue our efforts to remove possible sources of difference and thus to contribute to assure the peace of Europe.

A Hitler

Neville Chamberlain

September 30. 1938.

$5.95

AMERICA IS IN DANGER

by General Curtis E. LeMay

"America is in danger.... We find ourselves in a purely defensive role, unable to make our will felt even in a conflict with a backward jungle country.... Our strategic nuclear superiority has given us much diplomatic strength in the past. Do we still have that strength? Do we have enough faith in our general war capability to prevail in a crisis? I think not. That is why America is in grave danger."

In this book Gen. Curtis E. LeMay—former member of the Joint Chiefs and first commander of the Strategic Air Command—closely analyzes and challenges the government's claim to have greatly strengthened our military position. He finds minor improvements in conventional forces, but actual reductions in nuclear capability and an over-all decline compared to Soviet forces.

General LeMay, while stressing the paramount need for civil control of the military, attacks civilian manipulation of technical military decisions as unprecedented and disastrous.

(continued on back flap)

(continued from front flap)

Assessing the strategic situation, General LeMay argues that our former policy of overwhelming nuclear superiority proved itself during the crises in Berlin, Taiwan, and Cuba, and produced twenty years of relative peace. Yet the current Administration has opted for a new and untested posture that permits, even encourages parity with Russia.

According to the author, we have fostered disunity in NATO—first, by failing to sign a German peace treaty (General LeMay proposes what he believes to be a workable solution), and second, by our nonproliferation policy, which, combined with complete dependence on massive retaliation for deterrence, has caused European leaders to question our nuclear guarantees.

While approving the decision to produce a thin-line antiballistic missile defense, General LeMay pleads for an urgent upgrading of this program, pointing to Russia's rapidly growing ABM force.

Finally, General LeMay analyzes our limited war strategy with particular reference to Vietnam and proposes immediate steps to insure not simply a military victory but a stable political and social solution.

As a man who has devoted his life to America's security, the author strongly believes that present defense policies endanger our ability to survive. In this urgent and thoughtful book General LeMay not only criticizes; he offers alternate solutions to bolster our strength and preserve peace.

FUNK & WAGNALLS
NEW YORK

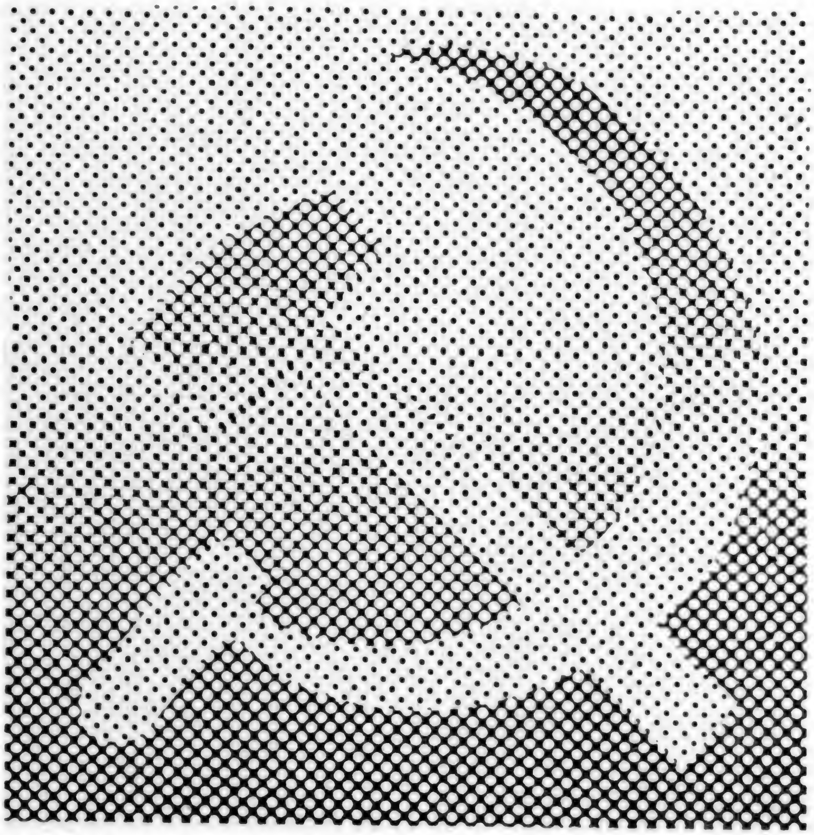
Jacket design: Paul Bacon Studio

Spencer Weart, Never at War: Why Democracies Will Not Fight One Another, Yale University Press, 1998:

"This idea had been developed by 1785 ... A world where every state was a democracy, [Immanuel Kant] wrote, would be a world of perpetual peace. Free peoples ... will make war only when driven to it by tyrants. ... there have been no wars between well-established democracies. ... the absence of wars between well-established democracies [has a probability of being coincidence] less than one chance in a thousand. ... robust statistics ... When toleration of dissent has persisted for three years ... a new republic [is] 'well established.' ... [Diplomatic pacifism made war by the 'appeasement trap' of trying to 'accommodate a tyrant.'] ... the tyrant concluded that he could safely make an aggressive response ... [thus] negotiating styles are not based strictly on sound reasoning."

Military Psychology

A Soviet View



Edited by:
V.V. SHELYAG
A.D. GLOTOCHKIN
K.K. PLATONOV

Moscow 1972

TRANSLATED AND PUBLISHED
UNDER THE AUSPICES OF
THE UNITED STATES AIR FORCE

ВОЕННАЯ ПСИХОЛОГИЯ

УЧЕБНИК
ДЛЯ ВЫСШИХ ВОЕННО-ПОЛИТИЧЕСКИХ
УЧИЛИЩ
СОВЕТСКОЙ АРМИИ
И ВОЕННО-МОРСКОГО ФЛОТА

Под редакцией
В. В. ШЕЛЯГА,
А. Д. ГЛОТОЧКИНА,
К. К. ПЛАТОНОВА

Ордена Трудового Красного Знамени
ВОЕННОЕ ИЗДАТЕЛЬСТВО
МИНИСТЕРСТВА ОБОРОНЫ СССР
МОСКВА—1972

Chapter 28. The Psychology of Agitation and Propaganda Activity

"Propaganda" and "agitation" are words of Latin origin. To propagandize means to disseminate knowledge, ideas, views, and theories, while to agitate means to stir up definite aspirations and arouse people to action.

However, the essence of our Party and Leninist propaganda is significantly deeper. It must not only disseminate and transmit revolutionary ideas, but also make them the convictions of the people. By agitation, we mean a direct appeal and ability to direct the energy and will of the people to struggle for carrying out the ideas of communism in practice.

A scientific explanation of the essence of communist propaganda and agitation as well as their unity and differences was provided by V. I. Lenin.

V. I. Lenin in his work *Chto Delat'?* (What Is to be Done?), from the example of explaining the question of unemployment to the masses, showed the difference between propaganda and agitation: ". . . The propagandist, if he takes, for example, the same question of unemployment, should explain the capitalist nature of the crises, show the cause of their inevitability in modern society, sketch the necessity of transforming it into a socialist society, and so forth. In a word, he should provide 'many ideas,' or so many ideas that all these ideas at once, in their aggregate, will be assimilated by only a few (comparatively) persons. But an agitator, in speaking on the same question, takes the most outstanding example or one which is best known to his listeners . . ."

"The art of any propagandist or agitator," stressed V. I. Lenin, "is in influencing a given audience in the best way, and making a certain truth for the audience as convincing as possible, as easy to assimilate as possible, and as visibly and strongly memorable as possible." V. I. Lenin, *Poln. sobr. soch.*, Vol 21, p 21.

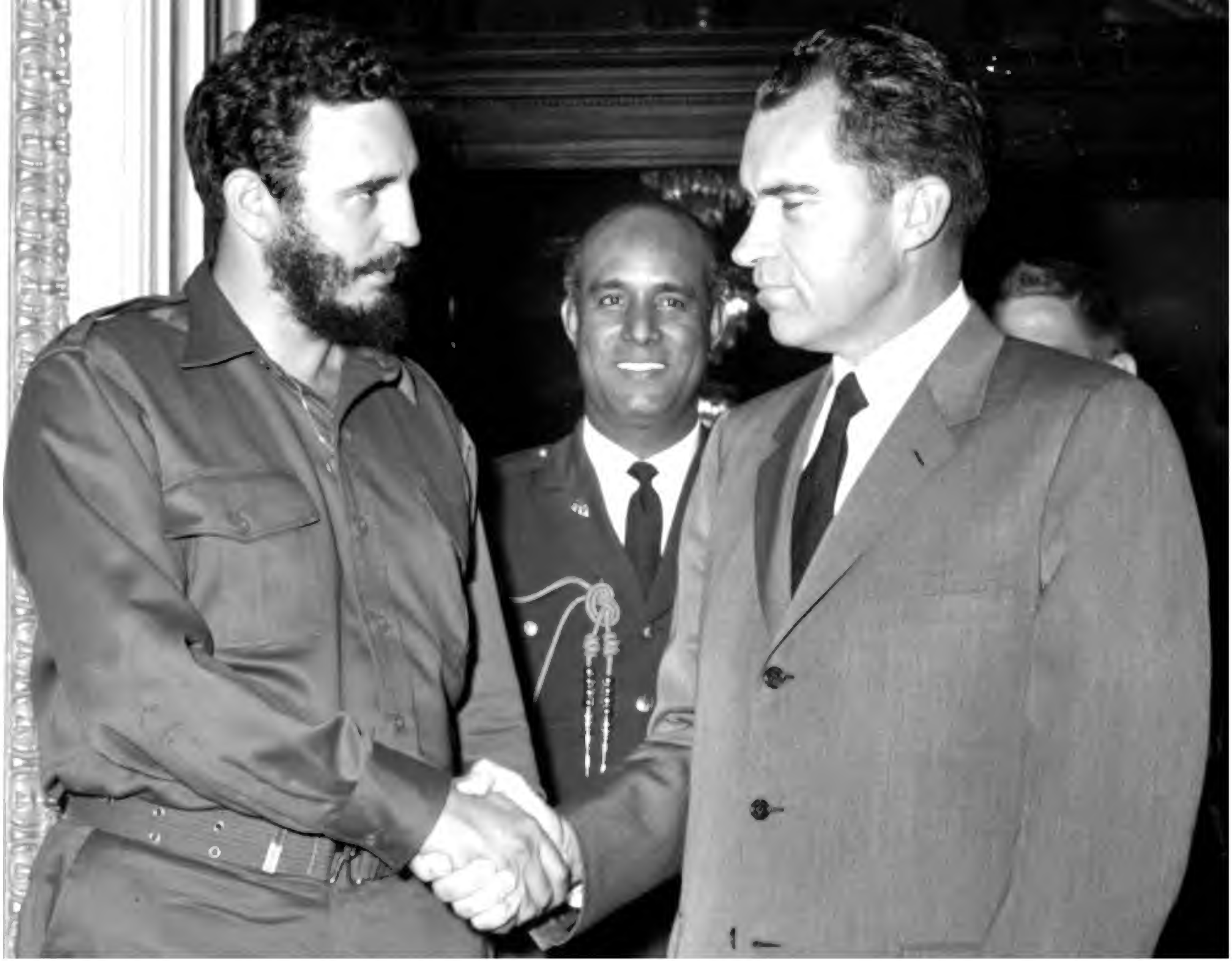
Convincingness is achieved by the propagandist's profound knowledge of theoretical problems and practical questions which he explains. A propagandist's speech is notable in its vivid exposition of the basic thought and main idea, reinforced with rich factual material, and enrichment of the listeners with new knowledge.

In propaganda, it is advisable to limit oneself in using obvious and reliable judgments, for an abundance of them frees the listener from the need to think, and teaches dogmatism.

Fourth, the words of an agitator will be convincing if and when these words are theoretically argued with sufficient profundity. The talk of an agitator is not only a conversation on current subjects, but also an explanation of a certain idea or theory. Only profound understanding of this idea by the masses will raise their revolutionary activeness which the agitator directs by his appeals in the appropriate manner. For this reason, a true agitator is a politically intelligent and ideologically convinced fighter for the Party. The best agitators are political workers, commanders, engineers, progressive-minded personnel, soldiers, and sergeants whose words are an authority for comrades.

Fifth, agitation cannot be effective if it is not capable of becoming a means for an emotional effect upon the listeners. The agitator influences the audience not only by his words, but by the entire range of his human personality, how he proves the theoretical theses, and by his tone and demeanor. The vivid and lively language of an agitator, and the most successful and intelligent form found by him for expressing an idea are important factors helping to carry out the agitation passionately and convincingly.

The observance of the listed conditions, which provide for the effectiveness of an agitator's talk, requires from him certain qualities, profound knowledge, high personal culture, combat and methodological preparation, ability to think logically, as well as the capability to come into contact with different people.



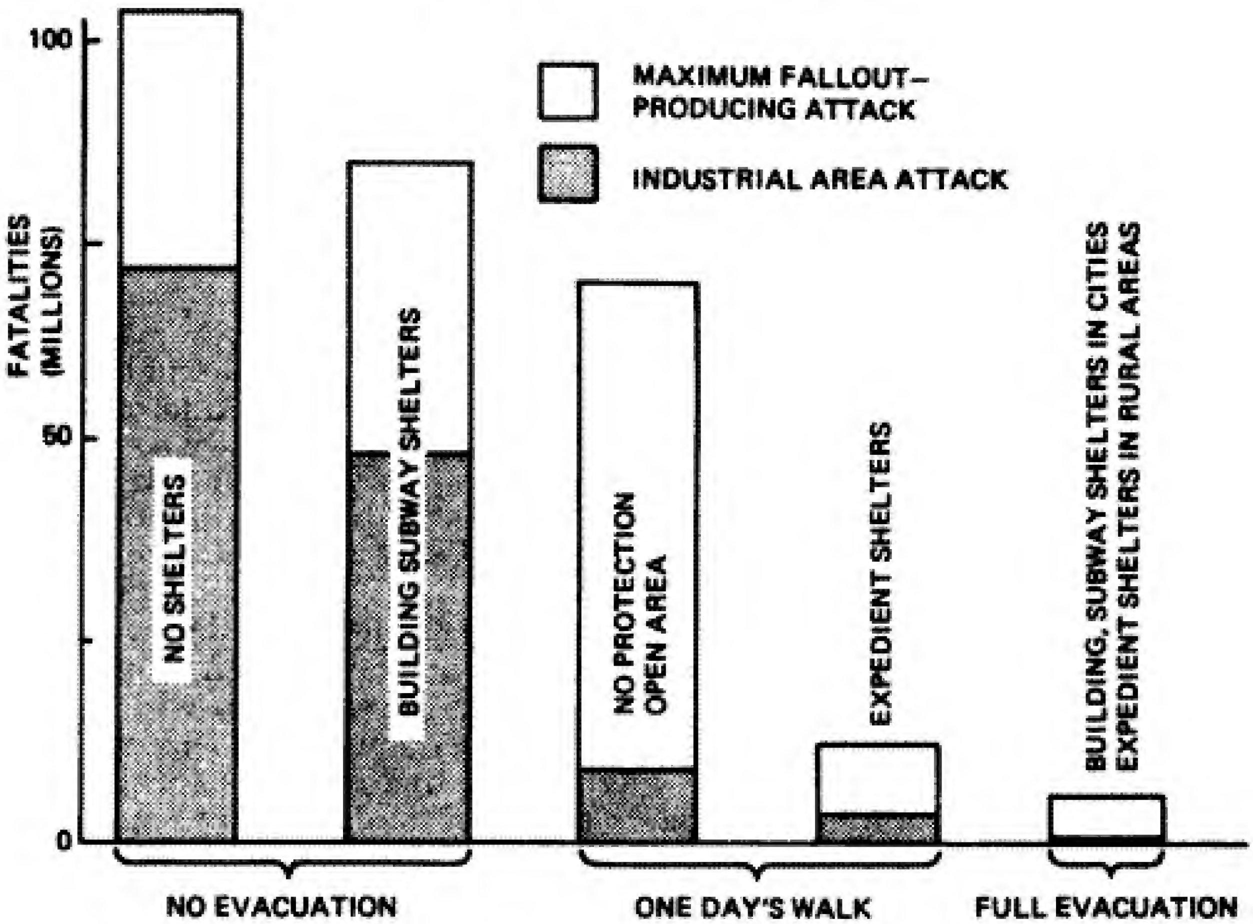
April 21, 1959 Cuban President Fidel Castro and Vice President Nixon

INDUSTRIAL PREPAREDNESS AND NUCLEAR WAR SURVIVAL

WEDNESDAY, NOVEMBER 17, 1976

U.S. CONGRESS,
JOINT COMMITTEE ON DEFENSE PRODUCTION,
Washington, D.C.

MR. THOMAS K. JONES



Soviet population fatalities (surviving U.S. Strategic Forces).

Robert Scheer

WITH ENOUGH SHOVELS:

Reagan, Bush & Nuclear War

"Dig a hole, cover it with a couple of doors and then throw three feet of dirt on top... It's the dirt that does it... if there are enough shovels to go around, everybody's going to make it."

—T. K. Jones, Deputy Under Secretary of Defense for Strategic and Theater Nuclear Forces

"President Ronald Reagan had been in office less than a year when he approved a secret plan for the United States to prevail in a protracted nuclear war. This secret plan, outlined in a so-called National Security Decision Document, committed the United States for the first time to the idea that a global nuclear war can be won."

With these words Robert Scheer, the distinguished national reporter for the *Los Angeles Times*, begins this astonishing revelation of how a handful of Cold War ideologues—led by the President himself—have reversed the longstanding American assumption that nuclear war means mutual suicide.

Robert Scheer's aim in *With Enough Shovels* is to expose the deadly course on which we are now embarked, a course that categorically rejects the strategic assumptions that prevailed from Presidents Eisenhower through Carter and that sustained the Nixon-Kissinger program of détente—a program which our current leaders call "appeasement."

Leon Gouré

WAR SURVIVAL IN SOVIET STRATEGY

USSR
CIVIL DEFENSE

With a Foreword by
AMBASSADOR FOY D. KOHLER

SECRET CIA report leaked to Reagan in 1979

integrated city and rural civil defense exercises. One exercise of this type occurred in 1975 at Lytkarino, a town of 40,000 people near Moscow and a probable relocation site for Muscovites. According to Soviet publications, thousands of people participated, communication and reconnaissance operations were conducted, and shelters were occupied by local workers. Another 1975 exercise, in Tul'skaya Oblast, involved the city of Kimovsk in Kimovskiy Rayon; this was known as an "integrated rayonal exercise." There may

LEON GOURÉ is a Professor of International Studies and Director of Soviet Studies at the Center for Advanced International Studies at the University of Miami. A graduate of New York University, Columbia University School of International Affairs and Russian Institute, and Georgetown University, he is the author of *Civil Defense in the Soviet Union, The Siege of Leningrad,* and *Soviet Civil Defense 1969-70*. He has also co-authored *Soviet Strategy for the Seventies: From Cold War to Peaceful Coexistence, The Role of Nuclear Forces in Current Soviet Strategy,* and *Soviet Penetration of Latin America* among others.

1st printing .... April 1976

2nd printing .... August 1976

Foreword

by Foy D. Kohler

Dr. Leon Gouré has devoted many years of study to Soviet civil defense and other war-survival policies and activities in the USSR. The area was one of his specialties while serving as a Senior Analyst for the RAND Corporation from 1951 to 1969, and he has continued his researches since joining the University of Miami in 1969 as Director of Soviet Studies and Professor in the Center for Advanced International Studies.

As a part of our work program for this larger undertaking, the Center has held a series of special conferences wherein we have subjected our methodology and research findings to critical review by outside experts, including authoritative academic and governmental specialists on Soviet affairs and high-ranking policy-action officers from Defense, State and other agencies directly concerned with U.S.-Soviet relations.

At two of these conferences, special attention has been given to the Soviet war-survival problem: One in June 1975 included an exploration of how war-survival capabilities fit into the Soviet appraisal of the present and future "correlation of world forces." The second, held in January 1976, included a thorough examination of the implications for U.S. security interests and U.S. policy choices of what Moscow is actually doing in the war-survival area.

Nearly all of the experts at our conference viewed the reasoning behind the overkill concept as "absurd." One cited as an example an article in the April 6, 1975 *Bulletin of the Atomic Scientists* in which the author argued that with its present stockpile of nuclear weapons the U.S. could destroy the world's population "twelve times over." The author's calculation was arrived at by multiplying the casualties per kiloton in Hiroshima and Nagasaki by the total number of kilotons in the U.S. nuclear arsenal and then dividing by the number of people living in the world. Such a calculation was characterized as completely misleading. Leaving aside such questions as how many U.S. weapons would survive a Soviet attack on this country and how many of the residue could be delivered on target, "it implies that means can be devised to collect the entire target population into the same density as existed in Hiroshima and Nagasaki and keep them in a completely unwarned and hence vulnerable posture. A statement of identical validity is that the world's inventory of artillery shells, small arms ammunition, or for that matter, kitchen knives or rocks can kill the human population several times over."

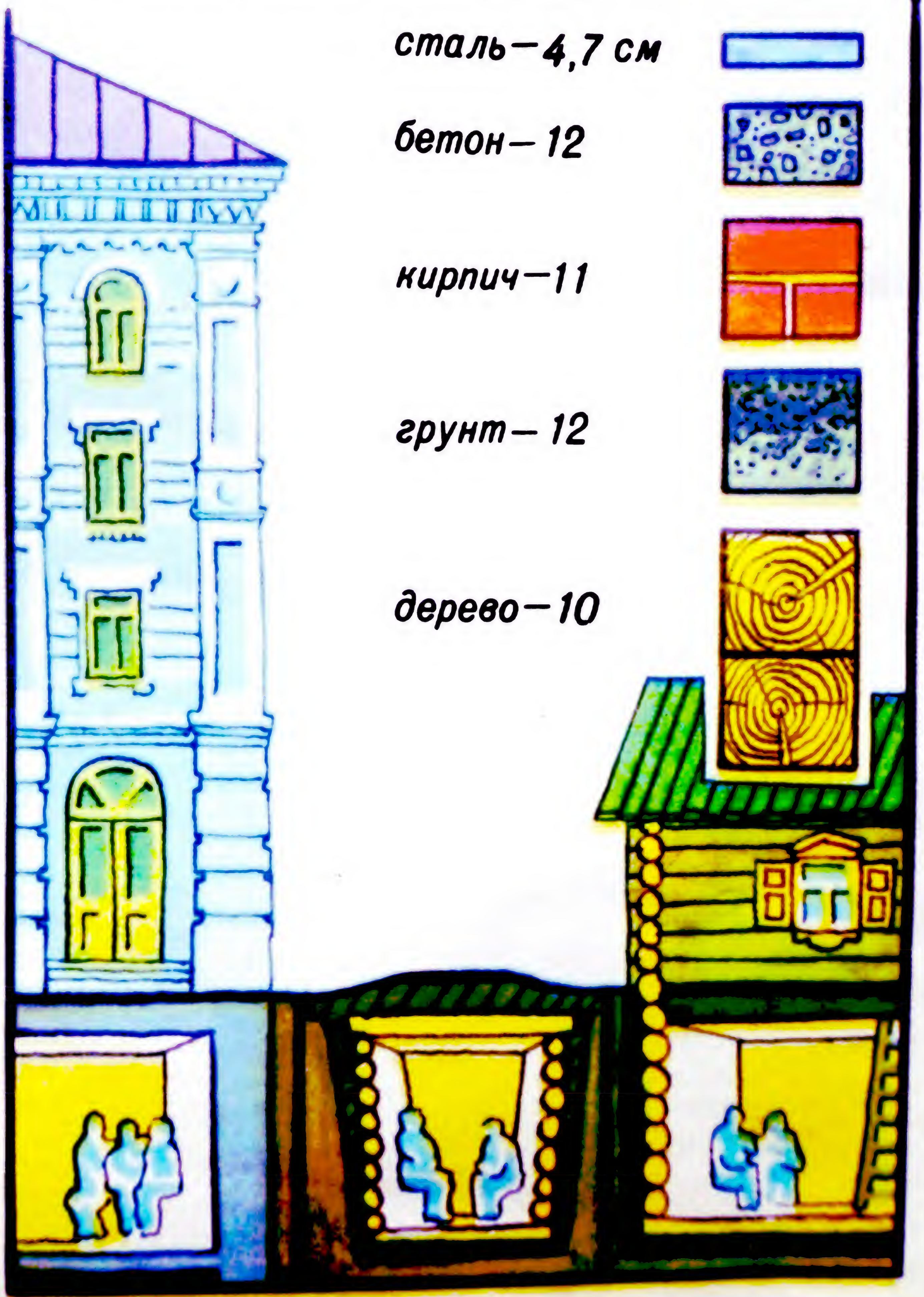
It was recalled that more than 10 billion pounds of TNT was dropped on Germany, Japan and Italy during World War II. This equalled more than 50 pounds for every man, woman and child in the three countries. Arithmetically considered, the result should have been the total annihilation of one and all of these. During the Vietnam War, more than 25 billion pounds of TNT were dumped on North and South Vietnam (15 billion by air and some 10 billion by other means) for an average of some 730 pounds for each of a total population of 34 million and an average of 3,000 pounds for each person in prime target areas; yet the U.S. was unable to kill enough people or to disrupt economic life, transportation and communications sufficiently to even avoid a humilitating defeat in the war.

The basic issue, it was agreed, is how Moscow intends to exploit the situation politically. The Soviet risk calculations and ability to use its military power for political purposes are already being increasingly influenced by Moscow's perceptions of asymmetries between the U.S. and Soviet war-survival versus assured destruction capabilities. According to Moscow's view, these asymmetries are of great strategic significance for making Soviet power credible as a deterrent and as an instrument of policy. Soviet spokesmen have given clear indication of their awareness of the lack of a war-survival program in the U.S. as well as of the vulnerability of the U.S. arising from the high degree of concentration of its population and industry in a few areas of the country. It is inevitable, therefore, that the Soviet leadership will perceive this asymmetry between the Soviet Union and the U.S. as altering the balance of forces in Moscow's favor, and as affecting the credibility of the respective strategic deterrence and war-fighting postures of the two countries.

In effect, with its growing war-survival capability, the Soviet Union could well conclude that the U.S. threat of "massive retaliation" has no credibility except as an act of sheer desperation. In crisis situations, this factor could decisively influence both sides' risk calculations and consequently their relative ability and willingness to hold a hard line. The Soviet Union could confront the U.S. with its ability to keep Soviet population and resource losses within acceptable limits, all the more so if it carries out the evacuation of its cities, as against the certainty of U.S. losses of 50 percent or more of its population and of a very large portion of its industry. This would place the U.S. at a great disadvantage in the management of the crisis and in its negotiations with the Soviet Union. Instead of a "balance of terror" which equally restrains both sides, the "terror" would be mainly on the part of the U.S. and, faced with the possibility of national "suicide," the public reaction to it would be likely to deprive the President of any flexibility in his policy choices in dealing with Moscow.

ЗАЩИТНЫЕ СВОЙСТВА МАТЕРИАЛОВ

Экспозиционную дозу радиации ослабляют вдвое материалы толщиной



~~Secret~~

Interagency
Intelligence
Memorandum

CIA HISTORICAL REVIEW PROGRAM
RELEASE AS SANITIZED

Soviet Civil Defense

~~Secret~~

NIO IIM 76-041
November 1976

Copy № 404

— *Basement*—shelters created by adapting the basement areas of residential, government, and industrial structures, primarily for protection against fallout. (See Figure 12.)

— *Subways*—shelters provided by using the subway tunnels in major Soviet cities. The degree of protection against blast varies within subways, but all afford good protection against fallout. (See Figure 13.)

— *Expedient or hasty*—shelters built with materials readily available during the period immediately prior to a nuclear attack. (See Figure 14.)

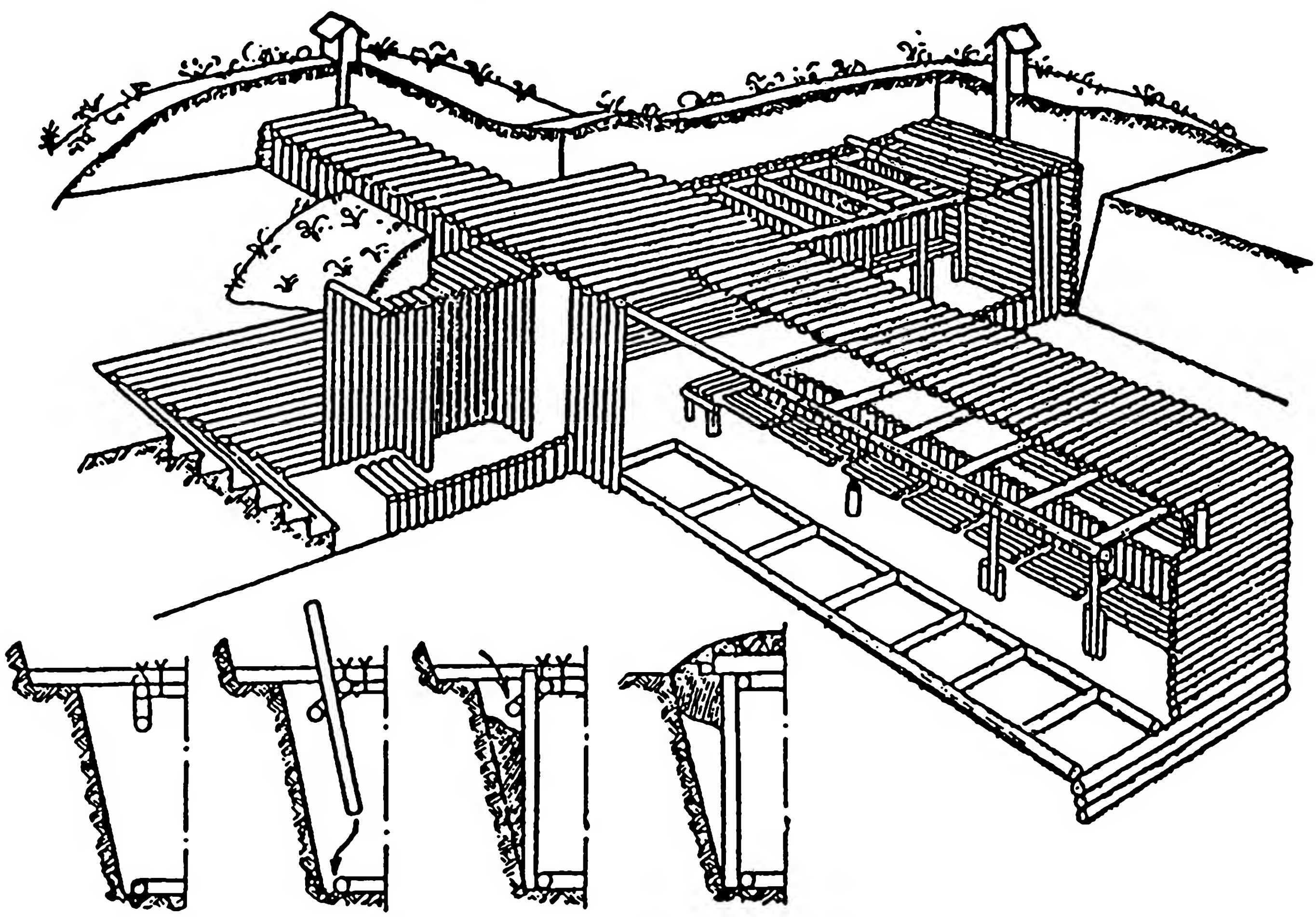
112. These several types of Soviet shelters offer varying degrees of protection against blast and fallout. According to Soviet planning, the type of shelter, its location, and the protection afforded are functions of the priority assigned to the survival of the protected personnel, the likelihood of direct attack or proximity to a target, and the availability of suitable structures that could be adapted as shelters.

113. Detached, bunker-type shelters, adaptable and built-in basement shelters, and subways are available for the protection of both essential workers and the general population. Dual-purpose shelters are also used as underground garages, clubs, and theaters which could be converted quickly to civil defense use.

114. Soviet writings and human sources have also referred to the use of various types of expedient, or temporary, shelters for protection from fallout. They consist of trenches lined with readily available materials and covered with earth. These shelters, which are described in more detail in paragraphs 139-141, are intended primarily for use by the rural population and by the urban population at dispersal and evacuation sites in rural areas. They could also be

Figure 14. Illustration of Soviet Expedient or Hasty Shelter

Diagrams such as this are provided in manuals widely distributed to the Soviet population for use in constructing hasty shelters in dispersal and evacuation areas.



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[USSR, "Antiradiation shelters in rural areas", 1972.]

or evacuee. In práctice, we believe—and emigrés have indicated—that conditions would be much more congested. Details on equipment and supplies for evacuees (including food, water, medicine, and fuel) are discussed later in this chapter.

134. *Time Requirements for Evacuation.* Soviet sources call for evacuation of Soviet cities within the "special period" (a period of warning) preceding an attack, and imply that the evacuation time would be about 72 hours. Soviet authorities have not published their assessment of actual time which would be required for evacuation of the nonessential population. Several US studies have addressed the speed with which the Soviets could complete their evacuation actions. A 1969 RAND study estimated that 100 million urban residents [27] could be evacuated in four days under optimum conditions, using only half of the available 1970 transportation capacity. A 1976 Defense Intelligence Agency study of the evacuation of 12 selected Soviet cities concluded that, under the most favorable conditions, the Soviets have a physical capability to evacuate most of the 12 cities within three to four days after movement begins. The major assumptions used in the DIA study were:

— 70 percent of population evacuated, 30 percent dispersed;

— two shifts working in essential industries and services;

— a six-hour alert preceding actual movements (this period of alert has been tested in Soviet exercises); and

— no other complications, such as panic, severe disruption of transport systems, or adverse weather conditions.

Figures 18, 19, and 20 and Table V summarize the findings of the DIA dispersal and evacuation study.

[27] This number of urban inhabitants equals the total population of some 450 cities with populations of 50,000 or more and includes almost all major administrative, residential, communication, and transportation centers.

TABLE V

DIA-Estimated Time Required for Evacuation of Twelve Selected Soviet Cities

City	Numbers evacuated (thousands) [1]	Maximum distance (km)	Maximum distance (nm)	Estimated time required after movement begins (hours) [2]	Modes of transport
Leningrad	2,673	[3]		117+	mostly rail, some maritime
Kiev	1,407	110	60	36	rail and highway
Tashkent	1,158	260	140	81	rail
Gor'kiy	914	315	170	75	rail and highway
Odessa	718	[4]		58	mostly rail, some maritime
Dnepropetrovsk	684	185	100	57	rail
Khabarovsk	351	410 [5]	220 [5]	56	rail
Orenburg	288	185	100	47	rail
Kishinev	331	75	40	39	rail and highway
Sevastopol'	187	165	90	29	highway
Angarsk	164	410 [5]	220 [5]	42	rail
Kirovabad	141	95	50	25	rail

[1] Represents 70 percent of city's inhabitants.

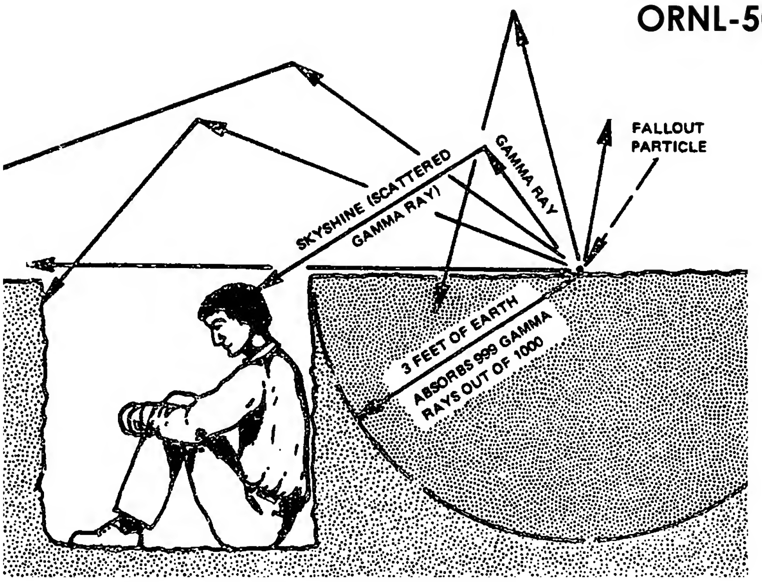
[2] Movement begins six hours after the alert. Methodology utilized in calculating evacuation times considers variables such as running speeds, loading and unloading rates, and sequences of unloading dictated by availability of facilities. Since these variables are not known quantities but judgments based on available evidence, the resulting figures for total evacuation time are approximate rather than exact values.

[3] Leningrad can accommodate some 90 large oceangoing ships which could offload evacuees at various ports along the Baltic coast, but a cycle time of three to four days is estimated before ships can return for more evacuees.

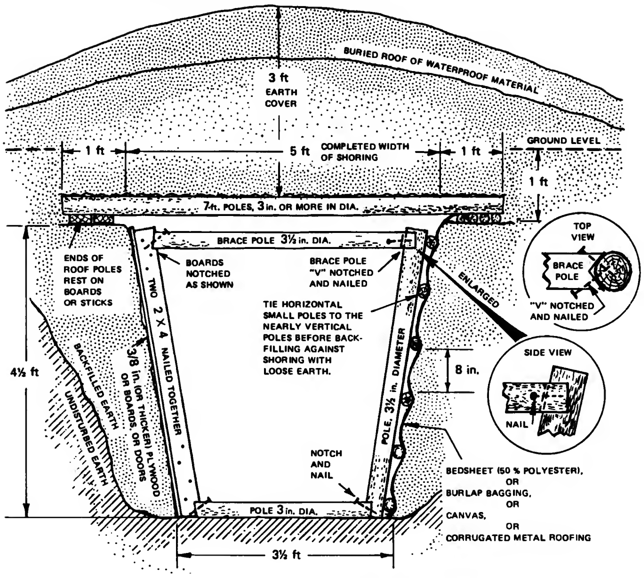
[4] Odessa, which can handle some 38 oceangoing ships, could offload evacuees in Romania and Bulgaria, but the cycle time for return of ships is four or more days.

[5] Distances for Khabarovsk and Angarsk are greater than for larger cities because of low population density in surrounding areas.

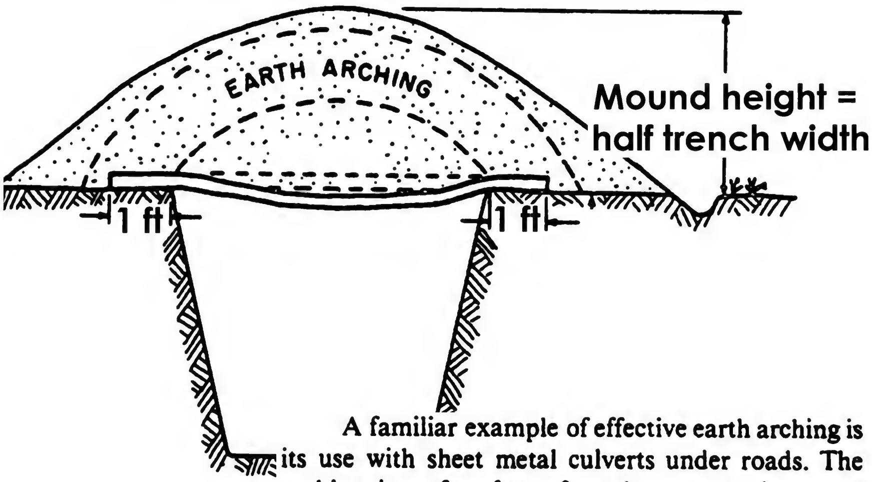
ORNL-5037



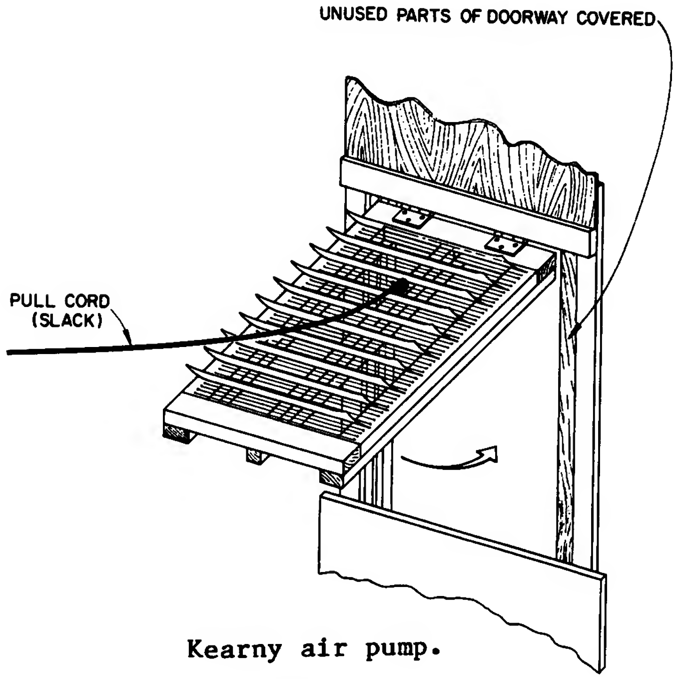
Methods for shoring a trench shelter.



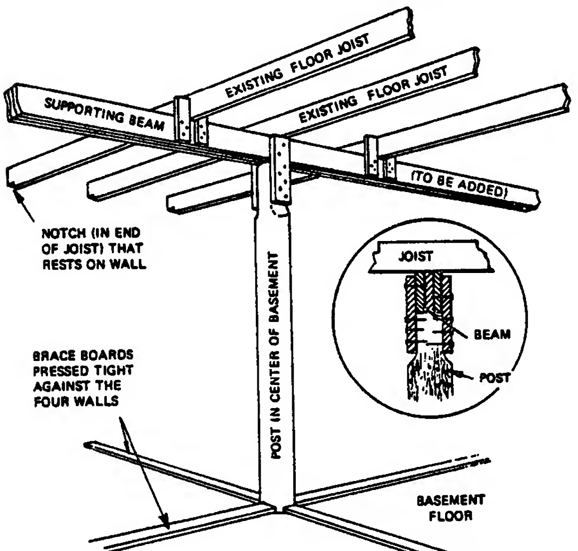
EARTH ARCHING USED TO STRENGTHEN SHELTERS

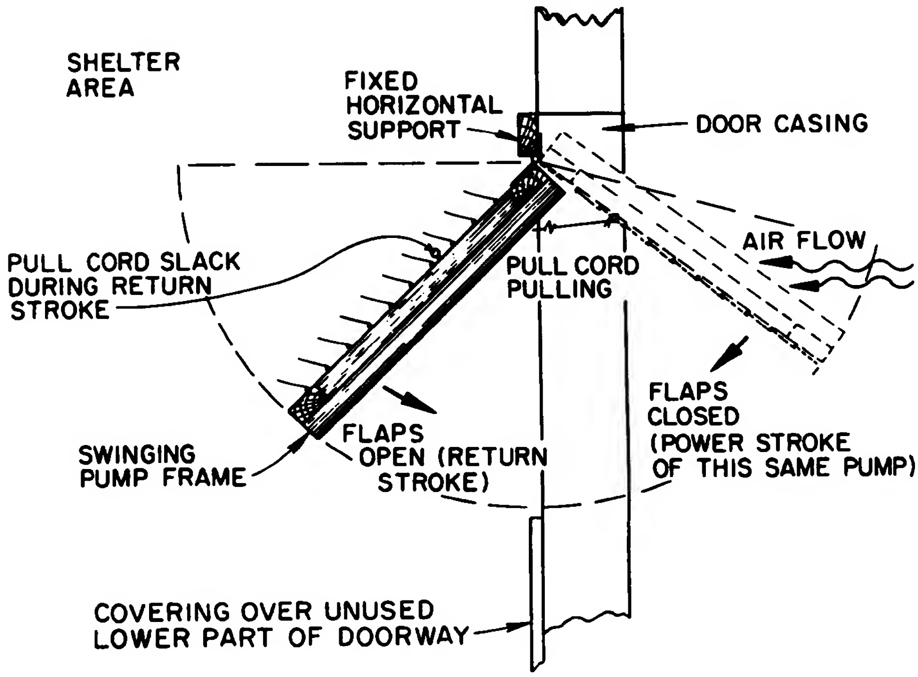


A familiar example of effective earth arching is its use with sheet metal culverts under roads. The arching in a few feet of earth over a thin-walled culvert prevents it from being crushed by the weight of heavy vehicles.



Kearny air pump.





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CAPABILITIES OF NUCLEAR WEAPONS [U]

CLASSIFICATION CANCELLED *
WITH DELETIONS
BY AUTHORITY OF DOE/OC
J. Diaz 1/29/91
REVIEWED BY DATE
* LTR DNA SWISHER TO DOE MA-235, 3-19-90
Kahn 2/13/91

United States Government Printing Office
Washington: 1964

[redacted]

GROUP-3
Downgraded at 12 year intervals;
Not automatically declassified.

Table 7-1 Estimated Casualty Production in Structures for Various Degrees of Structural Damage

Structural damage	Killed outright	Serious injury (hospitalization)	Light injury (No hospitalization)
		Percent*	
1-2 story brick homes (high explosive data):			
Severe damage	25	20	10
Moderate damage	<5	10	5
Light damage		<5	<5
Reinforced-concrete buildings (Japanese data, nuclear):			
Severe damage	100		
Moderate damage	10	15	20
Light damage	<5	<5	15

*These percentages do not include the casualties that may result from fires, asphyxiation, and other causes from failure to extricate trapped personnel. The numbers represent the estimated percentage of casualties expected at the maximum range where the specified structural damage occurs. For the distances at which these degrees of damage occur for various yields see Chapter 8.

example, although such effects as capacitor discharge are usually referred to as transient effects, the time constant for recovery of the capacitor to its normal operating potential may be so long that recovery may not be effected before the mission of the system involved is complete. In this instance the effect would be classified as permanent damage even though the capacitor itself would have eventually completely recovered.

ELECTROMAGNETIC PULSE RADIATION DAMAGE

a. General. Permanent damage due to overheating or puncturing of insulation is possible where the electromagnetic pulse energy is high, where the induced voltage triggers an electrical fault and the damage energy is supplied by the affected system, or where the electromagnetic pulse energy is carried for some distance along a cable or line as a power surge.

Interruption of service may occur where the voltage induced in a cable or line causes fuses to blow or circuit breakers to trip. This may take place many miles away from the point of detonation due to transmission of the surge. An interruption could also result if an electronically stored program were subjected to a strong enough transient electromagnetic field to scramble it.

Transient disturbances to electronic systems may occur in several ways. The electromagnetic pulse may be received via the signal or power lines acting as antennae. Or, the low frequency portion of the pulse may penetrate the enclosures and directly induce transient signals in the circuits.

Many instances of all three kinds of damage, i.e., permanent, interruptive and transient, have been experienced. So far, little if any, correlation of damage with measured electromagnetic field strengths has been established. This has been the result of factors previously described, and of uncertainty of the point where electromagnetic pulse pickup actually occurred in cases where many cables and lines were in use for power, signal, control and mechanical purposes.

b. Power System Damage. Very regular zero-time tripping of power circuit breakers at a substation more than 30 miles away was observed on one series of tests. Standby personnel were always posted to reset the breakers to keep electrical equipment functioning. Within a mile of ground zero, pinholes in underground cable insulation have frequently been found. Such cables carried up to 4160 volts.

At power distribution stations, porcelain cutouts have been observed to arc over and the fuses have often blown. At other stations power transformers have been shorted internally or have had insulating bushings destroyed. Ordinary lightning protective devices provided inadequate protection against the electromagnetic pulse, in those cases.

c. Signal System Damage. Damage to signal systems has also been frequent in the form of burned or fused relays, potentiometers, cable insulation and conductors, as well as blown or damaged meters. In many instances, reviews of the circuits have shown that induced energy caused the damage, rather than triggered system energy. Free ends of cable pairs have often arced and melted.

d. Electronic System Damage. Oscilloscope presentations have frequently been disturbed or obliterated, even as far as 11 miles from ground zero.

Pulse counters in a timing circuit have been scrambled directly by the induced field (this effect has actually been duplicated in a simulation test in which a 1 mfd capacitor was charged to several thousand volts, then discharged into 10 turns of wire wound around the cabinet). Memory circuits employing magnetic elements may be vulnerable to the magnetic field, *H*, in a direct manner, as well as to the time derivative of the field.

Elaborate protective measures against electromagnetic effects have been devised, on occasion, such as extensive grounding plate systems, double-walled screen rooms, precautions against forming loops, and special bonding. These measures appeared effective on certain occasions, but on others, when higher yield weapons were tested, the precautions did not always suffice.

General recommendations for protection against electromagnetic pulse radiation damage cannot yet be made. Protective measures to be taken will depend principally upon the nature of the target and the degree of protection required.

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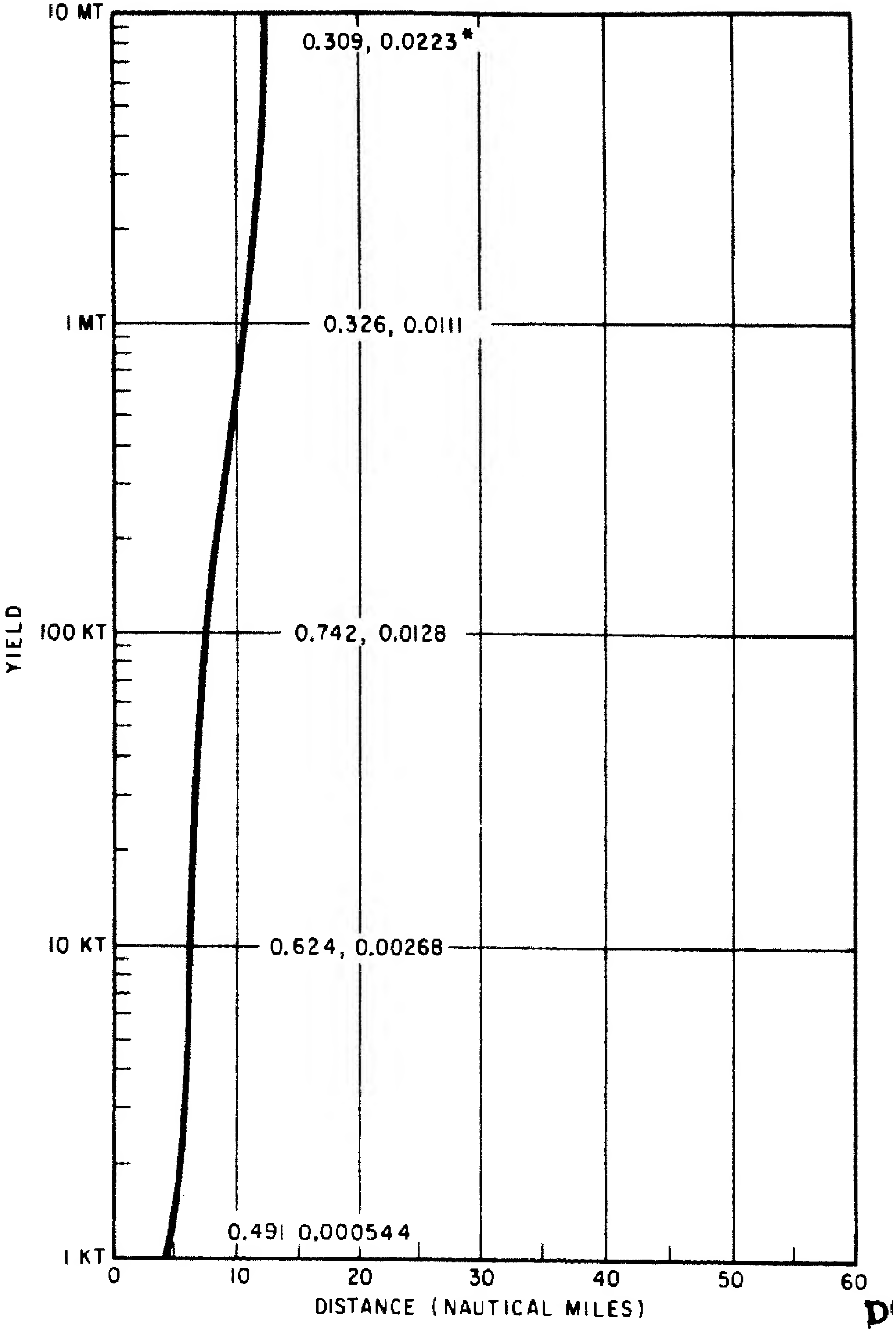


*EACH PAIR OF VALUES INDICATE, RESPECTIVELY, CALORIES AT THE CENTER OF THE IMAGE AND CALORIES ON THE LENS SURFACE

SEA LEVEL (BURST AND OBSERVER)
WATER VAPOR PRESSURE: 5mm HG
PUPILLARY DIAMETER: 3mm

Figure 7-3. Yield vs. Maximum Distance at which a Retinal Burn will be Formed. Visibility 10 Statute Miles; Standard Normal Day, and Daytime Adapted Eye

13-5 FIRE IN URBAN AREAS. The employment of an air burst weapon over urban areas may produce, besides blast damage, mass fires which, under proper conditions, materially increase the degree and extent of damage. The behavior of such fires, whether they are of primary or secondary origin, follows the pattern of fires in forest and wildland areas. The burning potential for urban areas varies with weather conditions, much as for wildlands; however, the fire season as such is not as pronounced as in wildlands. During those seasons when weather conditions may reduce exterior potentials to zero, dwellings are usually heated, so that interior fuels are dried out. Fire incidence and subsequent fire buildup depend also upon the amount and distribution of flammable material used in interior furnishing and building construction, the incidence of interior kindling fuels, and the relative cleanliness of the living habits of the population.

13-6 Ignition Points. A survey of metropolitan areas in the United States indicates that the incidence of exterior ignition points can be correlated with urban land use. Table 13-1 presents a relative tabulation based on exterior kindling fuels. Newspapers and other paper products account for 70 percent of the total, and dry grass and leaves account for another 10 percent in residential areas. Most other exterior kindling fuels are present in small percentages or require radiant exposures in excess of 10 cal/cm^2 for ignition. Weathered and badly checked fences and building exteriors that contain appreciable dry rot constitute an ignition hazard. The tabulation presented in table 13-1 is not representative of European cities and other areas where fuel is at a premium, or where extensive use is made of stone, brick, masonry, and heavy timber construction. Multistory buildings and narrow streets reduce both interior and exterior primary ignitions, because such ignitions are proportional to the amount of sky seen from the location of the probable ignition point.

Table 13-1 Relative Incidence of Ignitions in Metropolitan Areas of the United States by Land Use (Based on Exterior Kindling Fuels).

Land use	Relative incidence
Downtown retail	1.0
Large manufacturing*	1.4
Good residential	1.6
Small manufacturing	3.8
Poor residential	5.2
Neighborhood retail	5.5
Waterfront areas	8.0
Slum residential	11.7
Wholesaler	15.1

* May be likened to a typical fixed military installation in the Z.1.

13-7 Humidity Effects. Because paper is the major exterior kindling fuel and is also an important interior fuel, the extent of ignitions may be estimated from the minimum radiant exposure requirements for newspaper. Figure 13-1 shows the radiant exposure required to ignite darkly printed picture areas and printed text areas of newspaper at 50% relative humidity. The effect of relative humidity on the ignition of this cellulosic fuel can be estimated by multiplying the ignition radiant exposures for the dry material by the factor, $1 + 0.005\,H$, where H is the relative humidity in percent. Maximum fire effects occur during daily periods of lowest relative humidity, usually mid-afternoon. Guides for estimating urban burning potentials are given in figures 13-2 and 13-3. Figure 13-2, which gives burning potential for urban areas when central heating is not in use, represents approximate values of wind speed and average daytime relative humidity conditions corresponding to low, dangerous, and critical burning potentials according to the following definitions:

Low. Slow burning fires; fire can be controlled at will. Control action can be on unit structure basis.

Dangerous. Fires burn rapidly; individual building fires combine to form an area fire. Organized action needed to confine fire to area originally ignited.

[redacted]

Table 13-2 Critical Radiant Exposures for Damage to Various Materials

ambient relative humidity of 65 percent

Material	Weight (oz/sq yd)	Color	Effect on Material	Radiant Exposure (cal/cm²) 40 kt	1 mt	10 mt
Clothing Fabrics						
Cotton	8	White	Ignites	32	48	85
		Khaki	Tears on flexing	17	27	34
			Ignites	20	30	39
		Olive	Tears on flexing	9	14	21
			Ignites	14	19	21
		Dark Blue	Tears on flexing	11	14	17
			Ignites	14	19	21
Cotton-nylon Mixture	5	Olive	Tears on flexing	8	15	17
			Ignites	12	28	53
Wool	8	White	Tears on flexing	14	25	38
		Khaki	Tears on flexing	14	24	34
		Olive	Tears on flexing	9	13	19
		Dark Blue	Tears on flexing	8	12	18
	20	Dark Blue	Tears on flexing	14	20	26
Rainwear (double neo-prene coated nylon twill)	9	Olive	Begins to melt	5	9	13
			Tears on flexing	8	14	22
Tinder Materials						
Paper, bond, typing, new (white)			Ignites	24	30	50
Newspaper, printed text			Ignites	6	8	15
Newsprint, dark picture area			Ignites	5	7	12
Paper, kraft, single sheet (tan)			Ignites	10	13	20
Rags (black, cotton)			Ignites	10	15	20
Rags (black, rayon)			Ignites	9	14	21
Tent Material						
Canvas, white, 12 oz/sq yd			Ignites	13	28	51
Canvas, OD, 12 oz/sq yd			Ignites	12	18	28
Aluminum aircraft Skin (0.020 in. thick) coated with 0.002 in. of standard white aircraft paint			Blisters	15	30	40
Sandbags, cotton, canvas, dry, filled			Failure	10	18	32
Construction Materials						
Roll Roofing, mineral surface			Ignites	—	>34	>116
Roll Roofing, smooth surface			Ignites	—	30	77
Plywood, douglas fir			Flaming during exposure	9	16	20
Sand, coral			Explosion*	15	27	47
Sand, siliceous			Explosion*	11	19	35
Rubber, pale latex			Ignites	50	80	110
Rubber, black			Ignites	10	20	25

* Popcorning

Table 7-2 Radiant Exposures for Burns Under Clothing

Clothing	Burn	40 kt	1 mt	10 mt
		Radiant exposures[1,2]		
Bare skin	none	2.0	2.6	2.9
	1°	2.6	3.1	3.5
	2°	4.6	6.3	7.0
Summer uniform (2 layers of light porous fabric)	none	5	6	7
	1°	10	16	21
	2°	12	20	26
Winter uniform (2 to 5 layers of tightly woven fabric)	none	7	10	12
	1°	13	21	29
	2°	16	26	36
Sub-artic and arctic (3 to 8 layers of tightly woven fabric)[3]	none	15	25	40
	1°	15	25	40
	2°	15	25	40

[1] Expressed in cal/cm^2 incident on skin or outer surface of clothing when the inner layer of the clothing is spaced 0.5 cm from the skin and when at least the first 70% of the thermal pulse is received normal to the surface.

[2] These values are sensitively dependent on many variables and are probably correct to within $\pm 50\%$ for the range of normal military situations.

[3] Burns to personnel wearing these heavy uniforms will occur only by contact with flaming or glowing outer garments. Some systems require in excess of 100 cal/cm^2 to produce burns by direct transmission of heat through the fabrics.

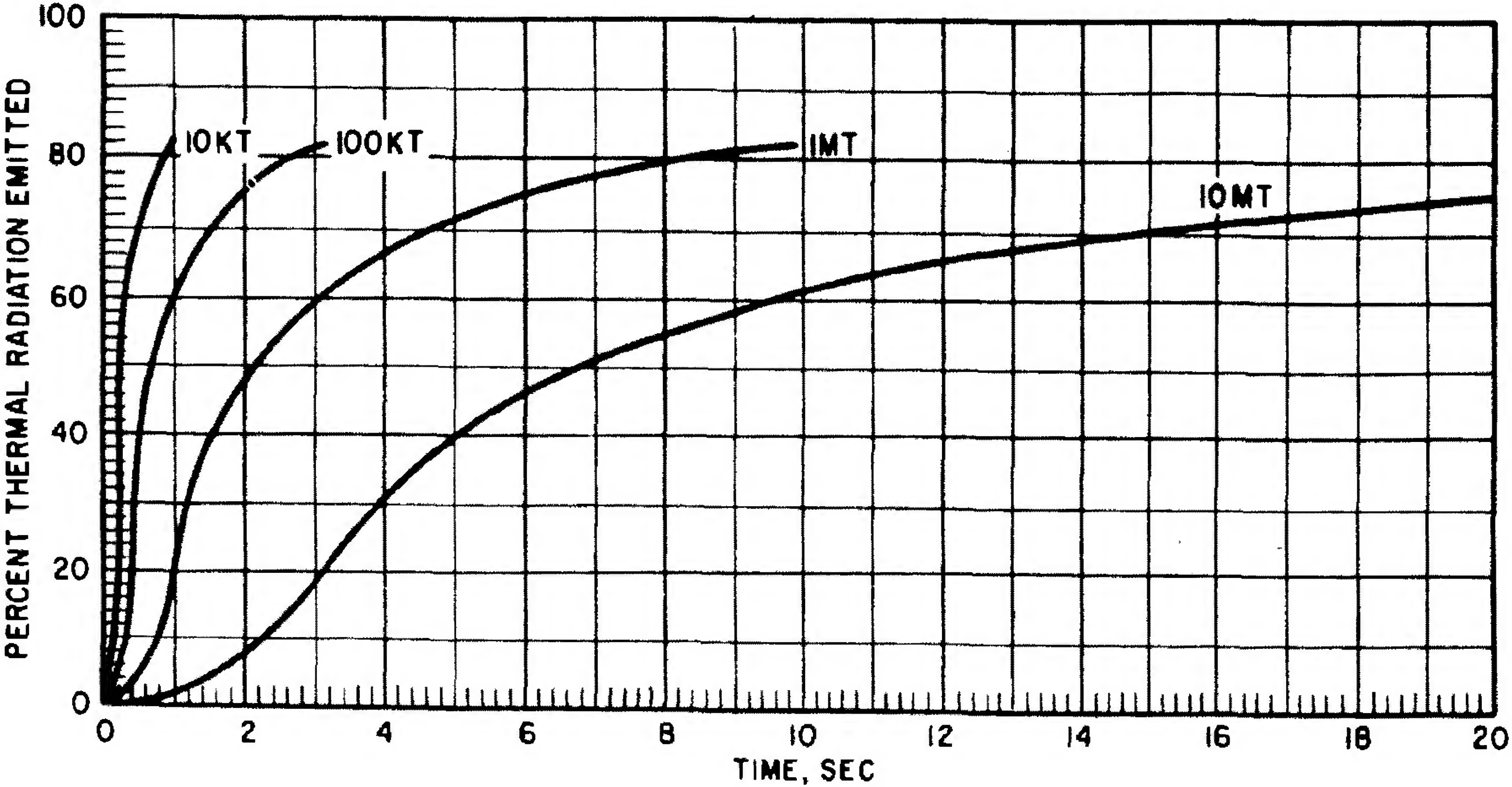


Figure 7-2. Percent Thermal Radiation Emitted vs. Time for Detonations Within the Atmosphere

Teapot-MET (1955)

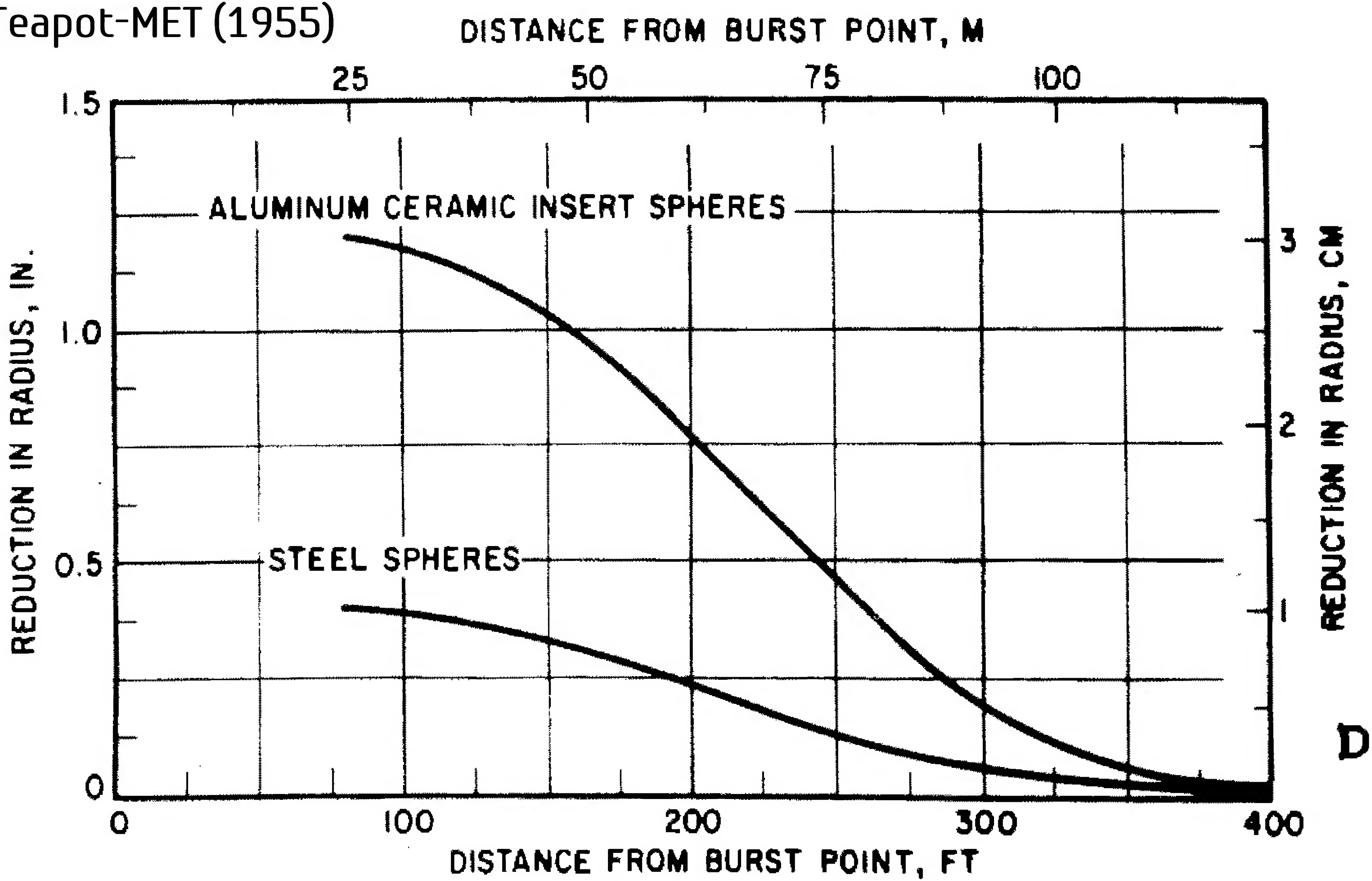


Figure 13-5. Reduction of Sphere Radius with Distance from a 23-kt Burst for Aluminum, Steel, and Ceramic Insert Spheres

Table 7-4 Summary of Clinical Effects of Acute Ionizing Radiation Dose

		Therapeutic range			Lethal range	
		100-200 rems	200-600 rems	600-1000 rems	1000-5000 rems	Over 5000 rems
Range	Subclinical range	Clinical surveillance	Therapy effective	Therapy promising	Therapy palliative	
Incidence of vomiting	None	100 rems: 5% 200 rem:: 50%	300 rems: 100%	100%	Up to 100%	
Delay time	——	3 hours	2 hours	1 hour	30 minutes	
Leading organ	None	Hematopoietic tissue			Gastro-intestinal tract	Central nervous system
Characteristic signs	None	Moderate leukopenia	Severe leukopenia; purpura; hemorrhage; infection. Epilation above 300 rems.		Diarrhea; fever; disturbance of electrolyte balance	Convulsions; tremor; ataxia; lethargy
Critical period postexposure	——	——	4 to 6 weeks		5 to 14 days	1 to 48 hours
Therapy	Reassurance	Reassurance, hematologic surveillance	Blood transfusion; antibiotics	Consider bone marrow transplantation	Maintenance of electrolyte balance	Sedatives
Prognosis	Excellent	Excellent	Good	Guarded	Hopeless	
Convalescent period	None	Several weeks	1-12 months	Long		
Incidence of death	None	None	0-80% (variable)	80-100% (variable)	95-100%	
Death occurs within	——	——	2 months		2 weeks	2 days
Cause of death	——	——	Hemorrhage; infection		Circulatory collapse	Respiratory failure; brain edema

Table 7-5 Dose Transmission Factors (Interior Dose/Exterior Dose)

Geometry	*Gamma rays* Initial	Residual	*Neutrons*[1]
Foxholes[2]	0.20	0.10	0.30
Underground—3 ft	0.04-0.05	0.0002	0.002-0.01
Builtup city area (in open)	—	0.70	—
Frame house	0.80	0.30-0.60	0.3-0.8
Basement	0.05-0.5	0.05-0.1	0.1-0.8
Multistory building:			
Upper	0.9	0.01	0.9-1.0
Lower	0.3-0.6	0.1	0.9-1.0
Blockhouse walls:			
9 in	0.1	0.007-0.09	0.3-0.5
12 in	0.05-0.09	0.001-0.03	0.2-0.4
24 in	0.01-0.03	0.0001-0.002	0.1-0.2
Factory, 200 x 200 ft	—	0.1-0.2	—
Shelter, partly above grade:			
With earth cover—2 ft	0.02-0.04	0.005-0.02	0.02-0.08
With earth cover—3 ft	0.01-0.02	0.001-0.005	0.01-0.05
Rough Terrain	—	0.4-0.8	—
Tanks: M-24, M-41, Tank Recov. Vehicle M-51, M-74	0.3-0.5	0.2	0.5-0.7
Tanks: M-26, M-47, M-48, T-43E1; Eng. Armd. Vehicles, T-39E2	0.2-0.4	0.1	0.3-0.6
Tractor, crawler, D8 w/blade	1.0	0.4	1.0
1/4-ton truck	1.0	0.8	1.0
3/4-ton truck	1.0	0.6	1.0
2-1/2-ton truck	1.0	0.5-0.6	1.0
Armd. Inf. Vehicle M-59, M-75, and 8P Twin 40mm Gun M-42	0.8-1.2	0.2-0.6	0.8-1.0
SP 105-mm howitzer M-52	0.6-0.8	0.4-0.6	0.8-1.0
Cruisers[3]			
Navigating Bridge	0.12-0.35	0.005-0.2	0.75
Superstructure Deck	0.008-0.25	0.0001-0.1	0.7
Main Deck	0.005-0.25	0.00003-0.1	0.7
Second Deck	0.0002-0.2	0-0.07	0.6
First Platform	0.0002-0.2	0-0.07	0.2-0.3
Second Platform	0.0001-0.10	0-0.01	0.05-0.15
Destroyer[3]			
Navigating Bridge	0.25-0.40	0.1-0.2	0.85
Superstructure Deck	0.015-0.40	0.00025-0.2	0.8-0.85
Main Deck	0.008-0.34	0.0001-0.2	0.75-0.8
First Platform	0.001-0.25	0-0.1	0.75-0.8
Second Platform	0.0005-0.20	0-0.07	0.5-0.75

[1] Estimated values.

[2] No line-of-sight radiation received.

[3] Assuming a beam-on orientation.

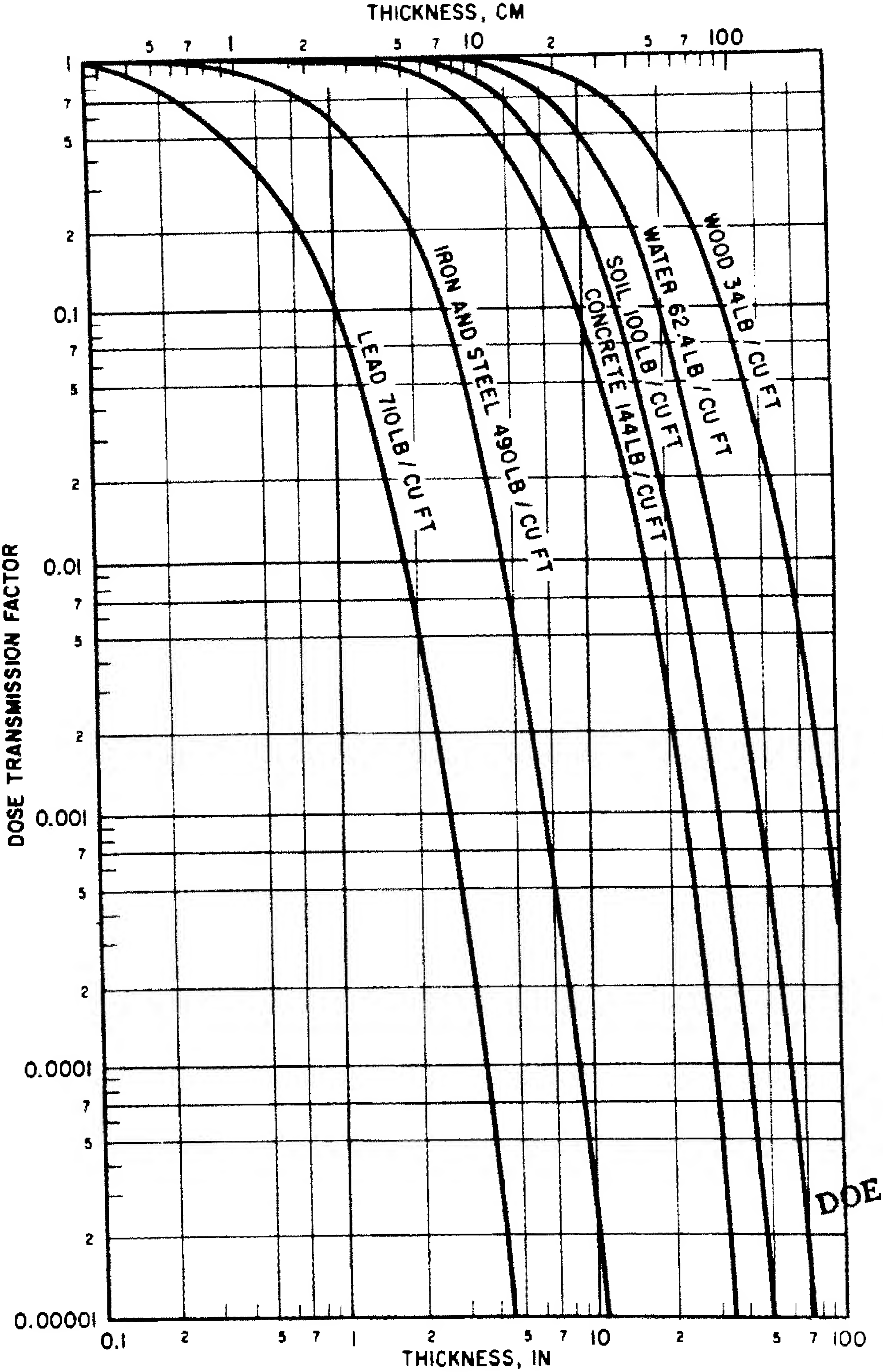


Figure 7-12. Shielding from Residual Gamma Radiation

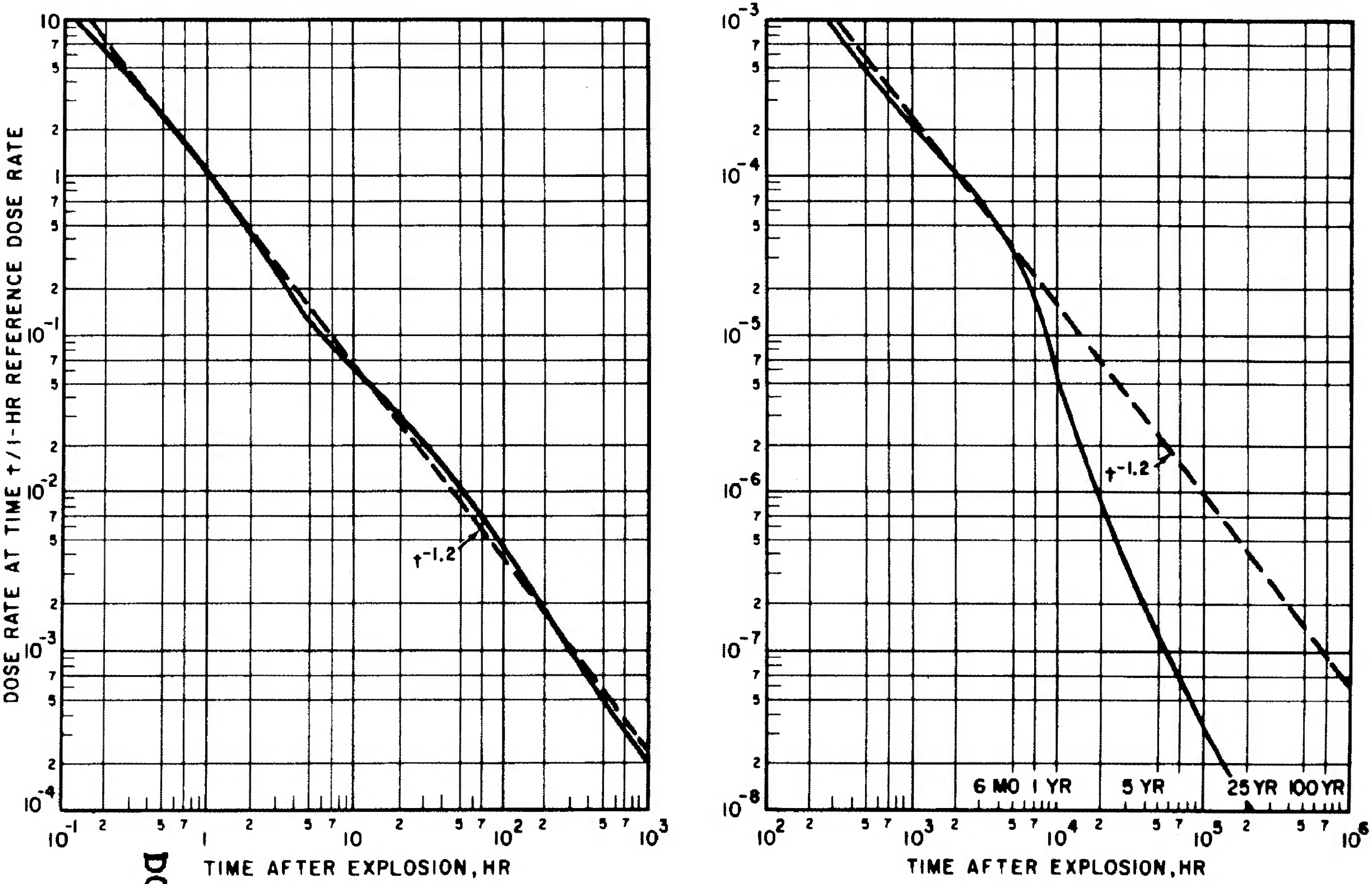


Figure 4-21. Fission-product Decay Factors Normalized to Unity,
1 hr after Detonation

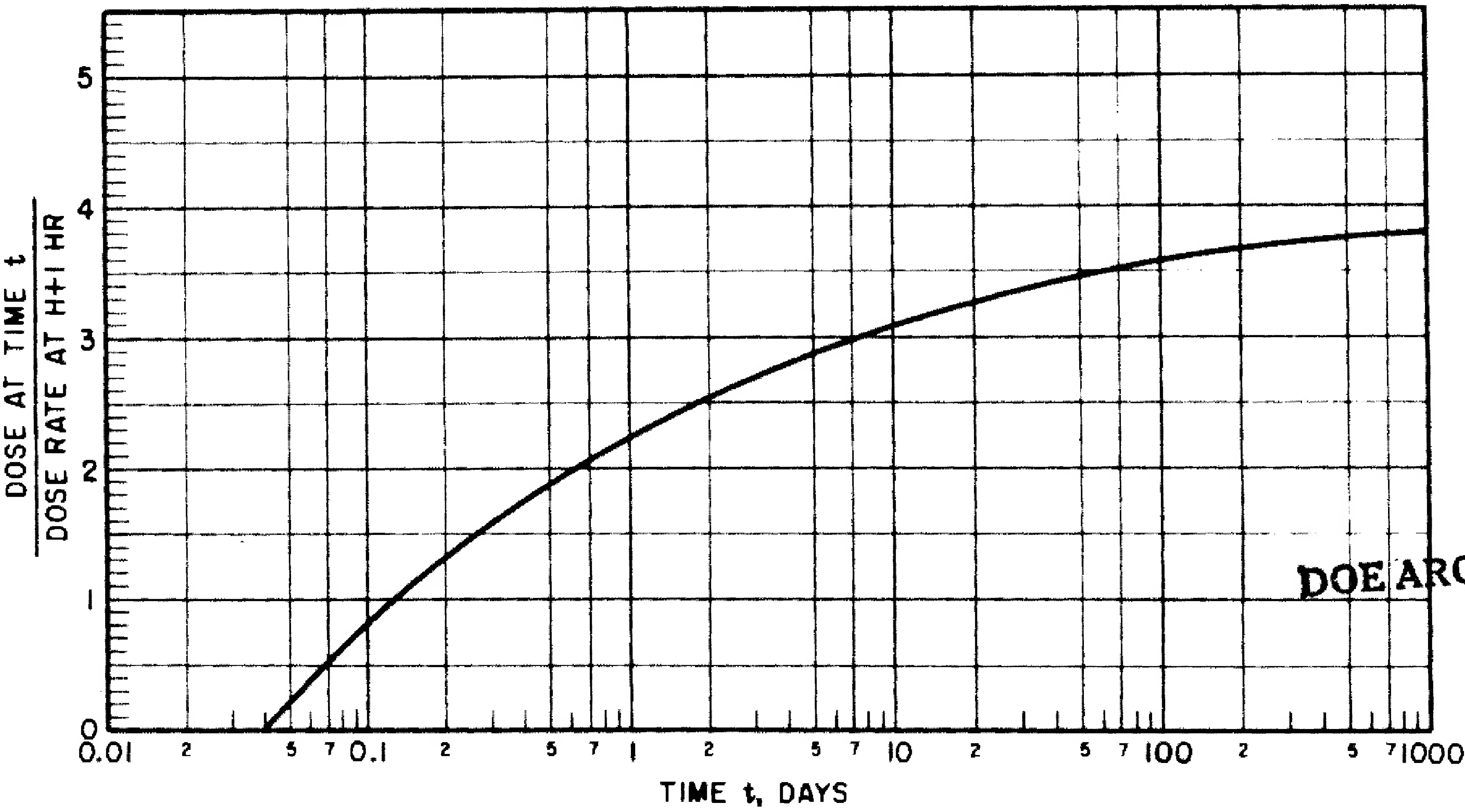


Figure 4-22. Normalized Theoretical Dose Accumulated in a Fallout-contaminated Area from $H + 1$ hr to $H + 1000$ Days

4-13 AIR BURST. The surface contamination effects of fallout from an air-burst weapon are militarily insignificant in most cases because the bomb cloud carries most of the radioactive bomb debris to high altitudes. In general, by the time this material can fall back to earth, dilution and radioactive decay decreases the activity to levels that are no longer militarily important. An exception may occur in the case of a small-yield weapon burst in the rain, where the scavenging effect of the precipitation may cause a rainout of radioactive material that will be hazardous to personnel located downwind and downhill, and outside the hazard area of initial radiation and other effects. Although the range of weapon yields for which rainout may become hazardous is not large, quantitative treatment of the problem is difficult. The contamination pattern on the ground depends upon the scavenging effect of precipitation on suspended fission products in the atmoshere, and the flow and ground absorption of rain water after reaching the ground.

Some of the factors that influence the scavenging effect are:

(1) Height and extent of the rain cloud

(2) Raindrop size and distribution

(3) Rate of rainfall

(4) Duration of precipitation

(5) Position of the nuclear cloud relative to the precipitation

(6) Hygroscopic character of the fission products

(7) Solubility of the fission products

(8) Size of the fission fragments

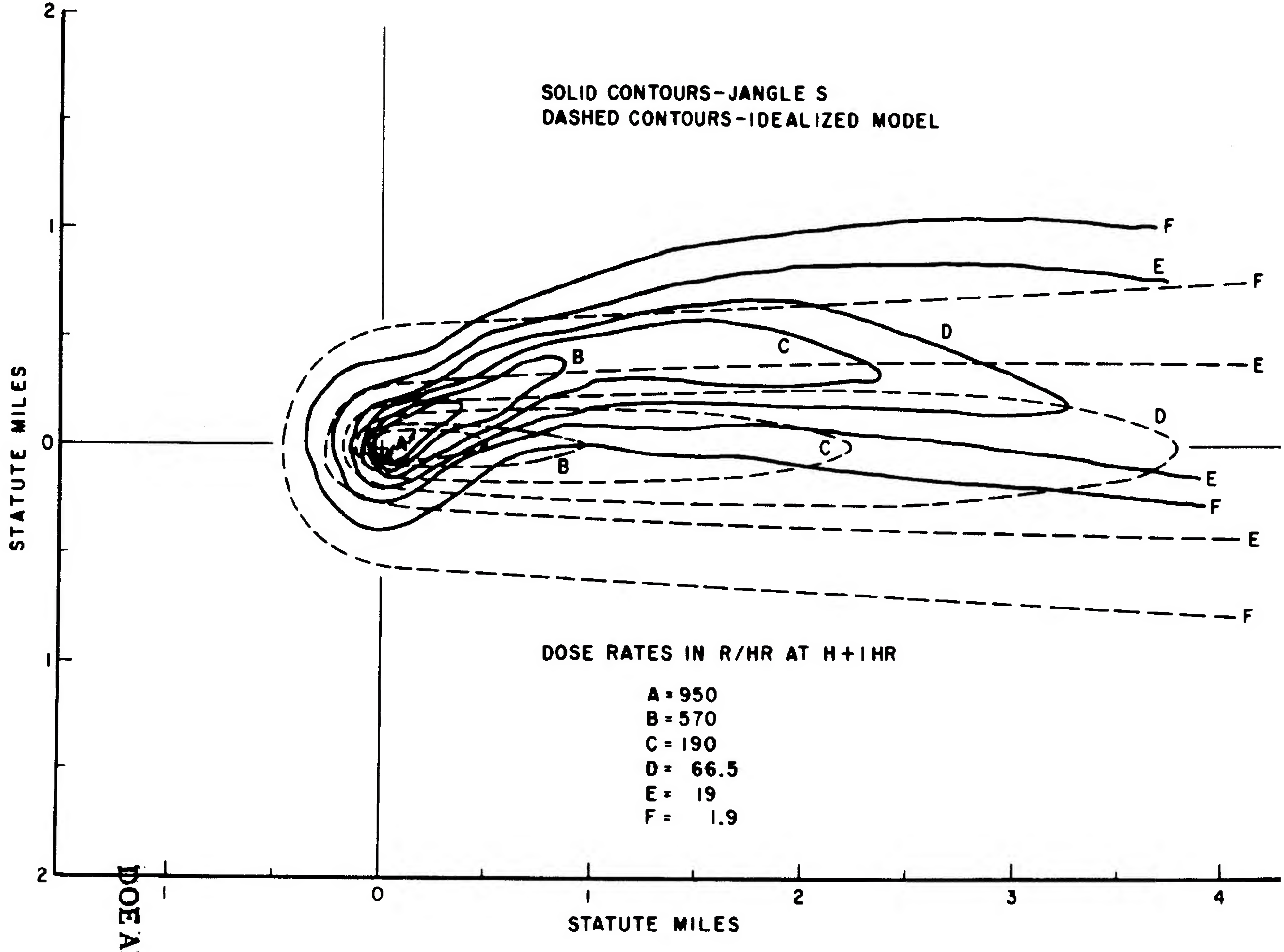


Figure 4-3. Comparison of Actual Fallout Contours with Idealized Model for a Yield of 1.2 kt and Effective Wind of 20 knots

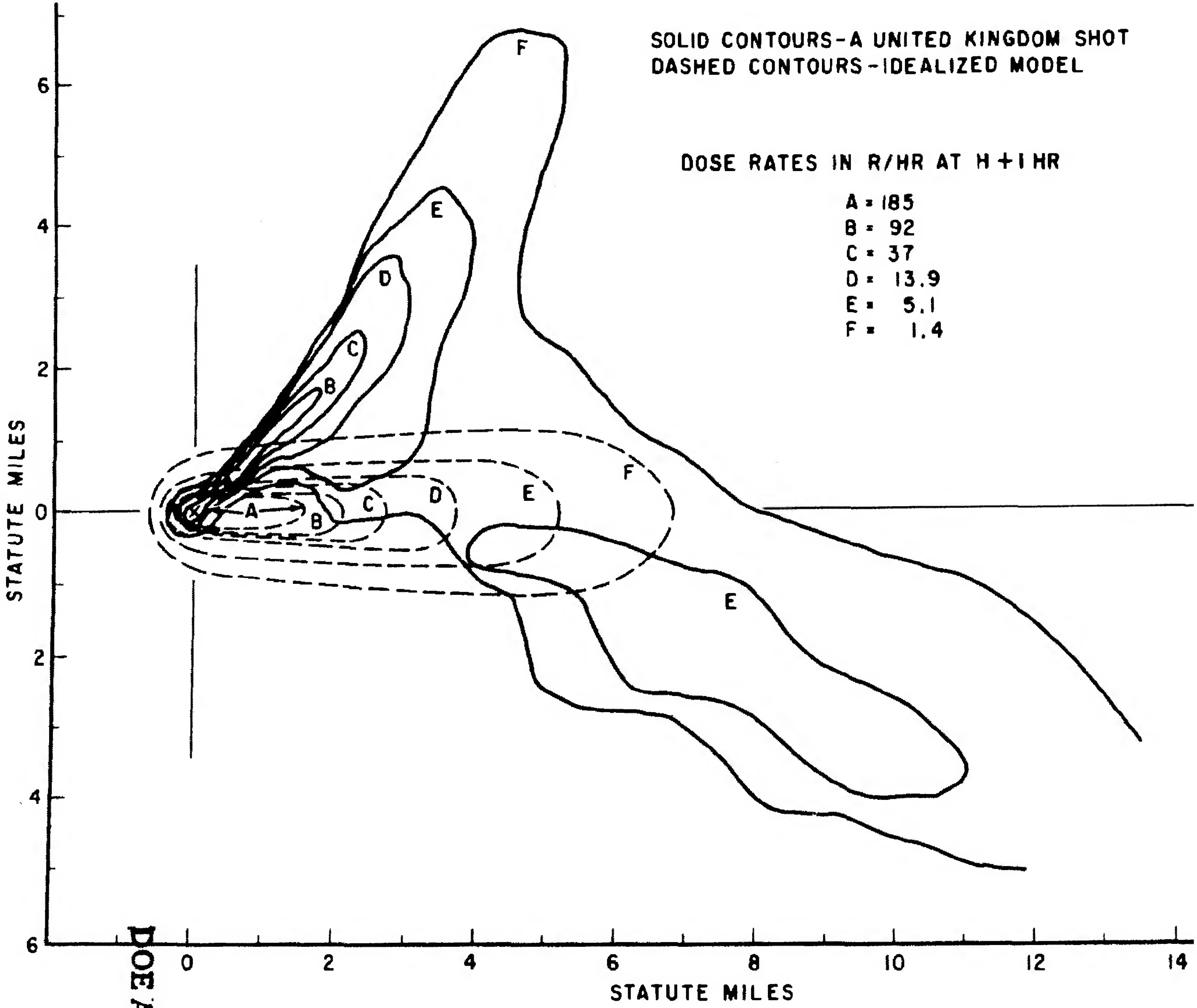
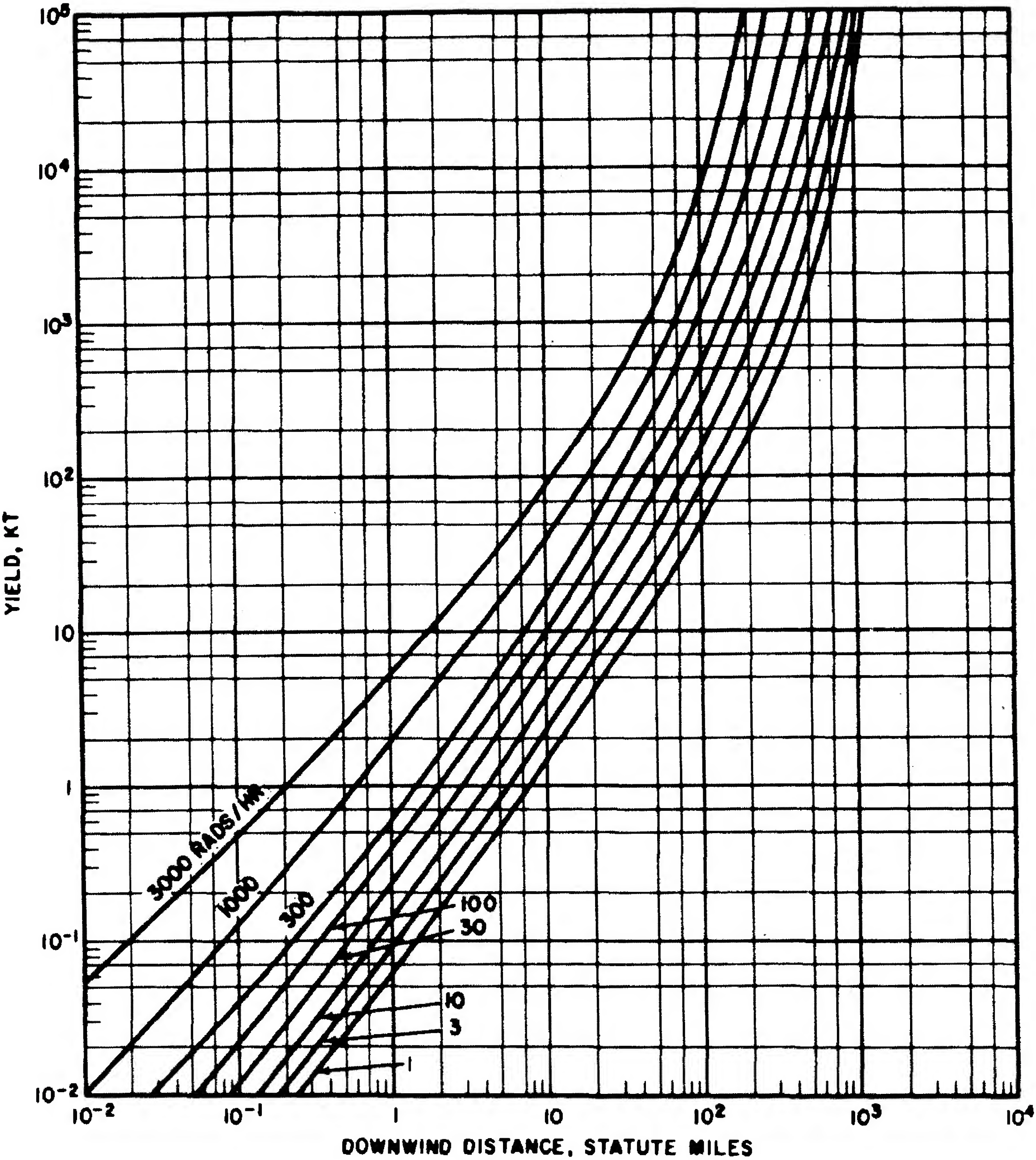


Figure 4-4. Comparison of Actual Fallout Contours with Idealized Model for a Yield of 1 kt and Effective Wind of 10 knots



DOE ARCHIVES

Figure 4-23. Yield vs. Downwind Distance, 10-knot Effective Wind

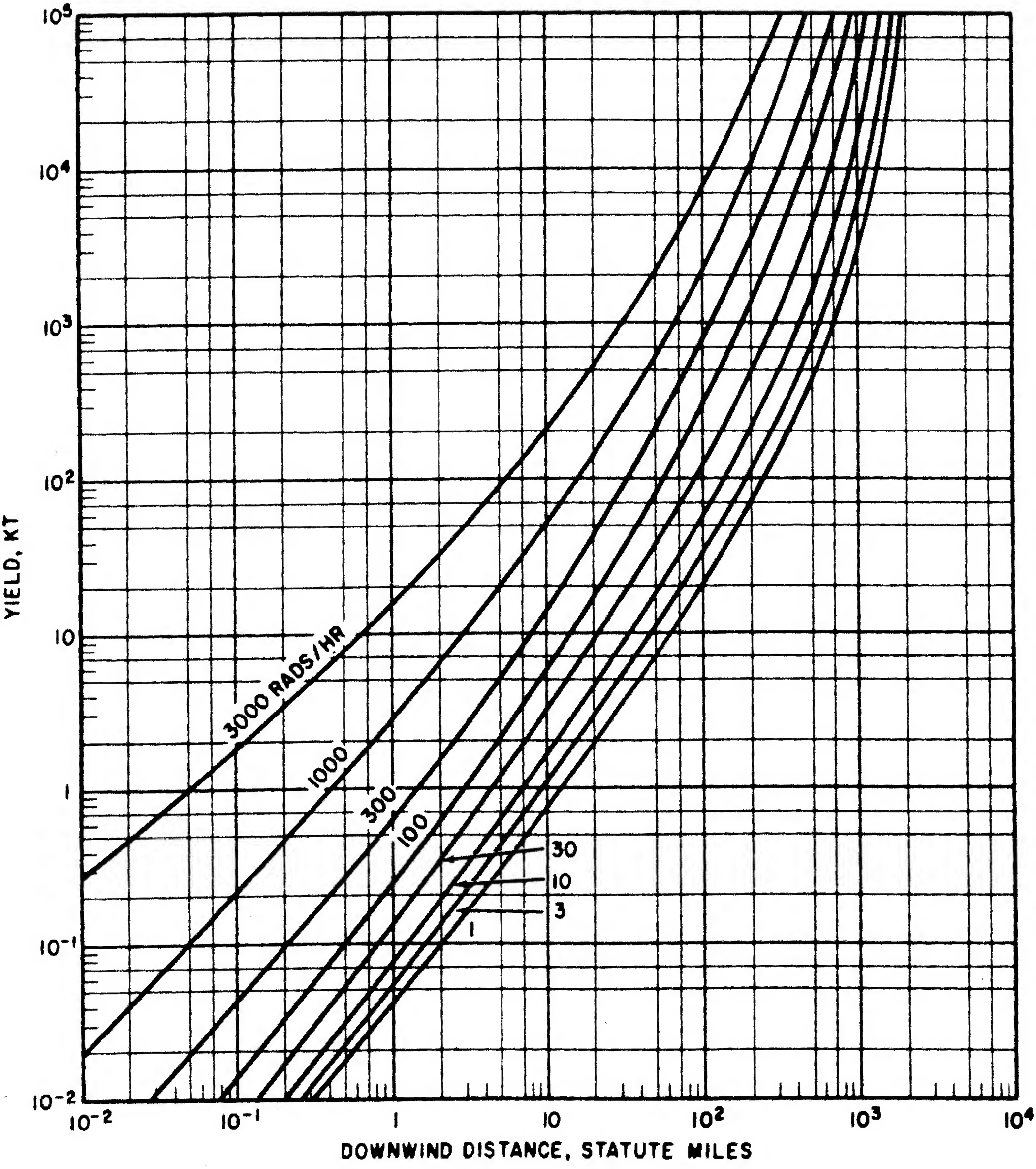
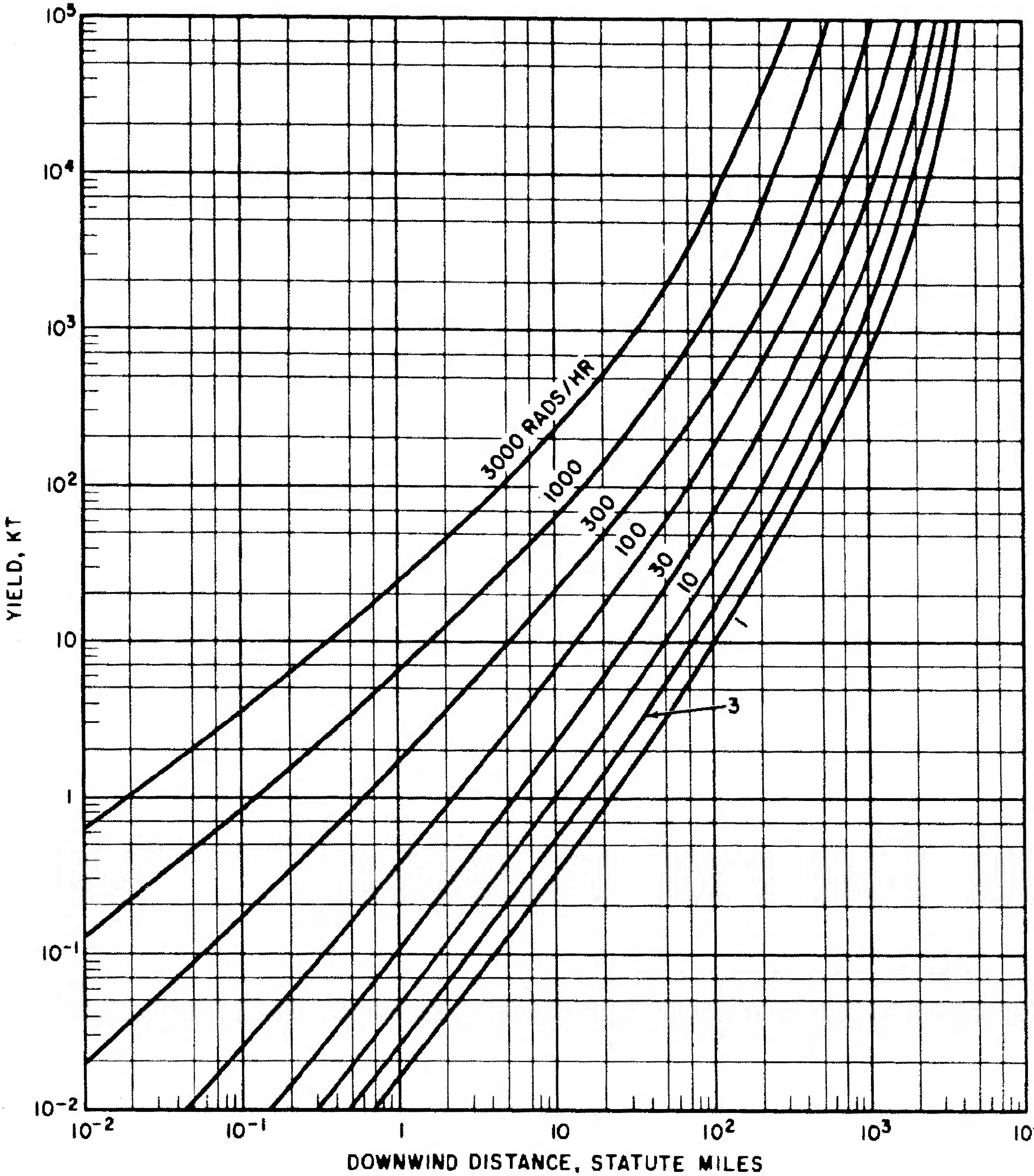


Figure 4-24. Yield vs. Downwind Distance, 20-knot Effective Wind



DOE ARCHIVES

Figure 4-25. Yield vs. Downwind Distance, 40-knot Effective Wind

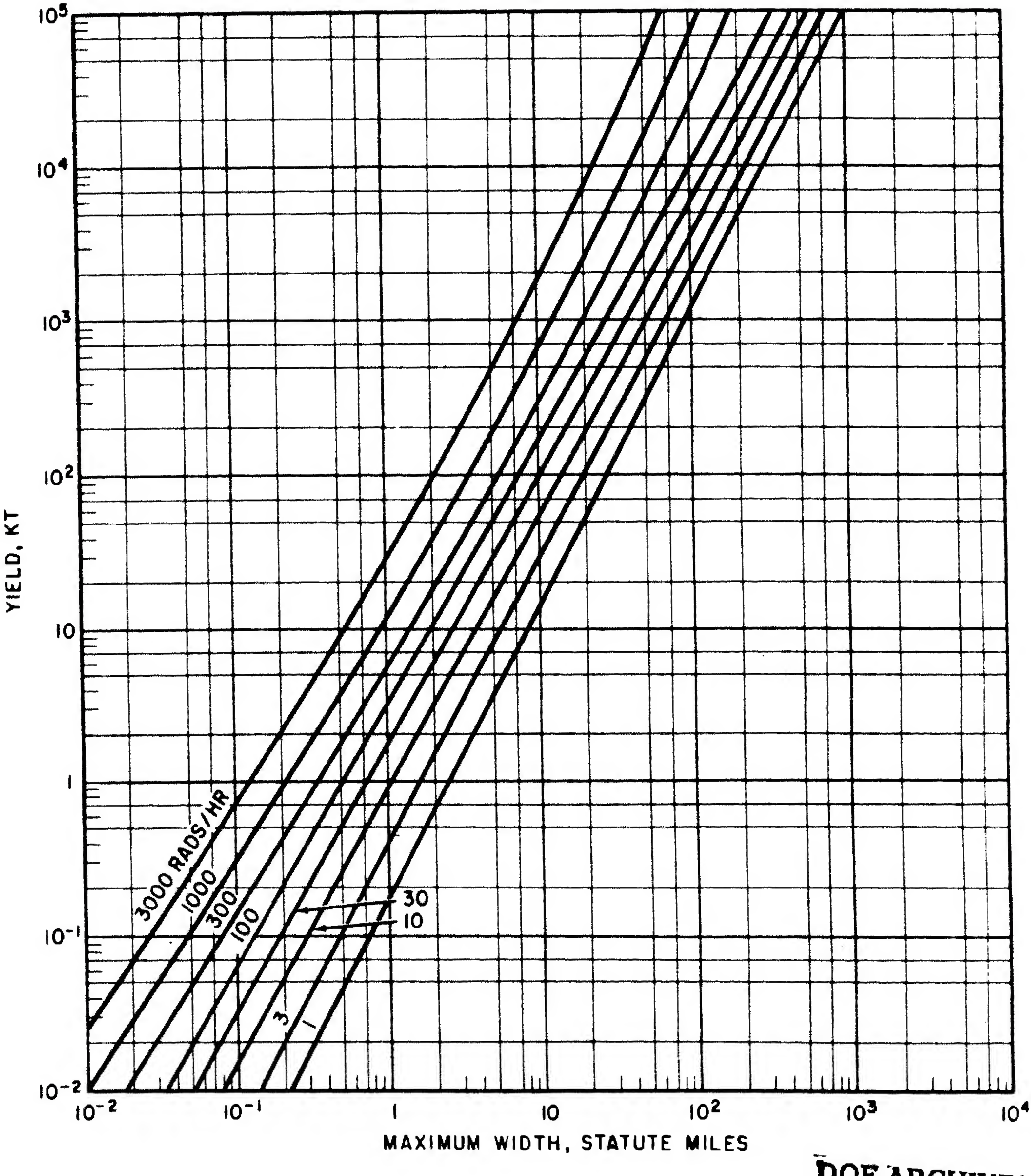


Figure 4-27. Yield vs. Maximum Width, 10-knot Effective Wind

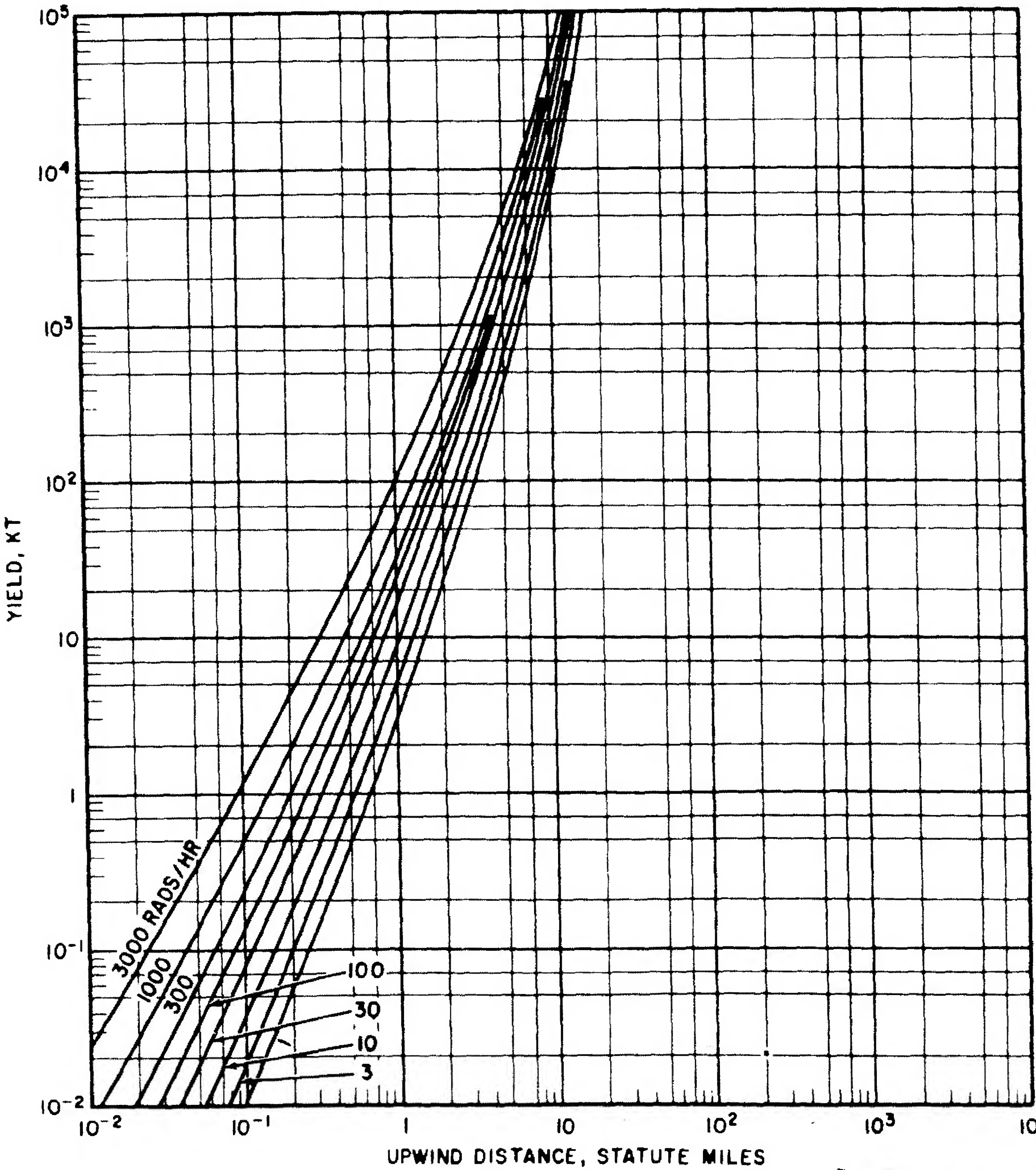


Figure 4-31. Yield vs. Upwind Distance, 10-knot Effective Wind

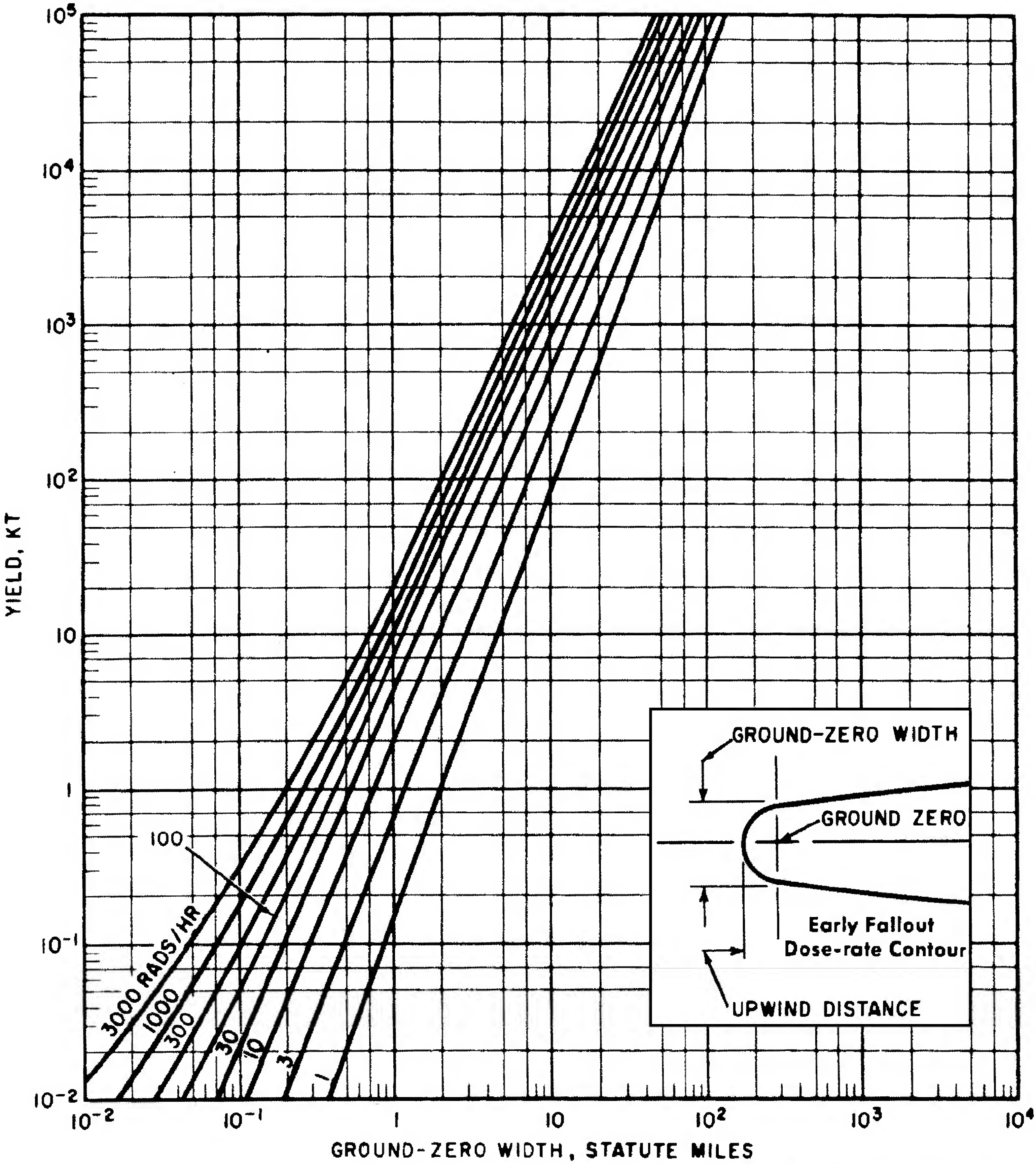


Figure 4-39. Yield vs. Ground-zero Width, 10-knot Effective Wind

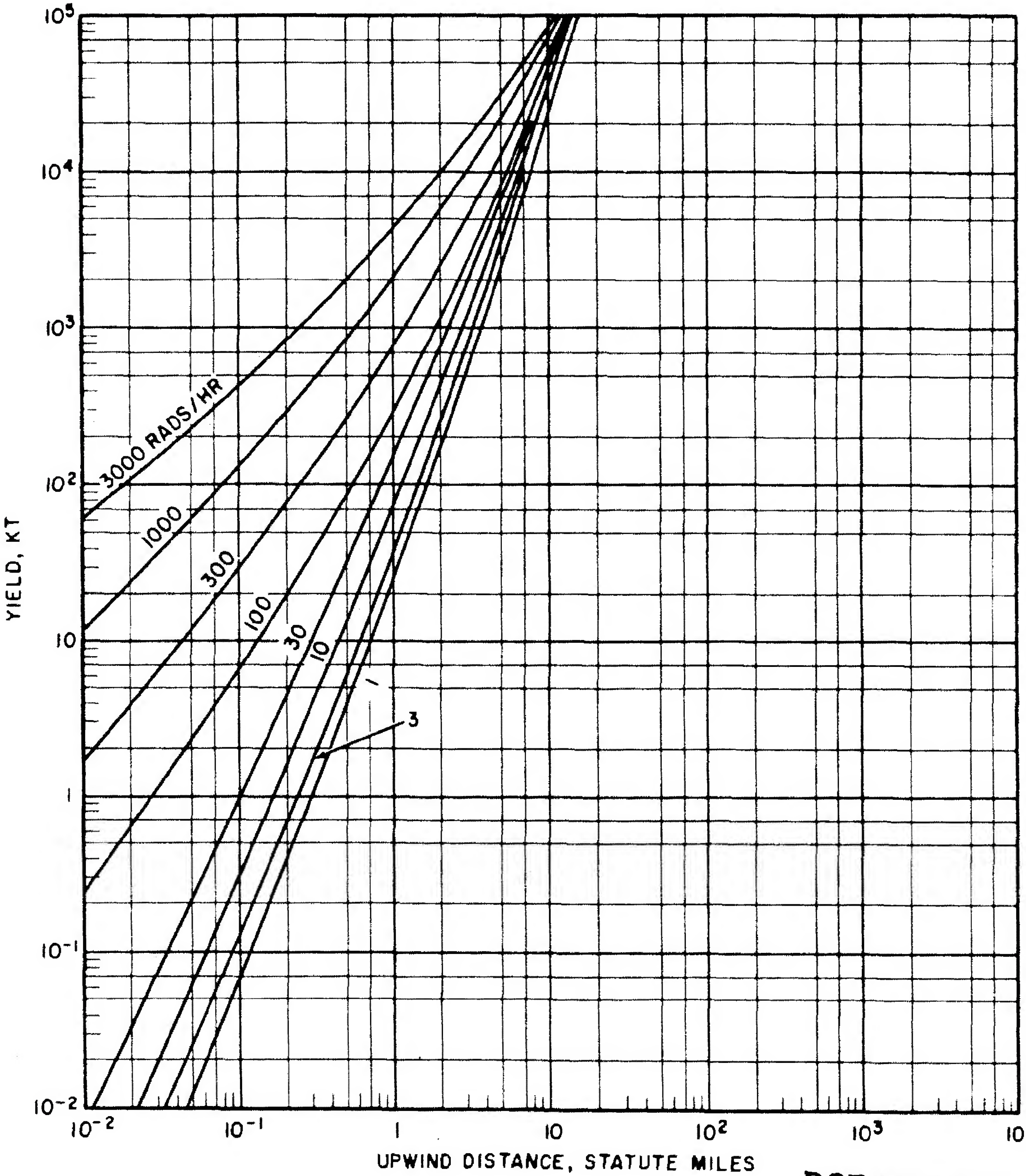


Figure 4-33. Yield vs. Upwind Distance, 40-knot Effective Wind

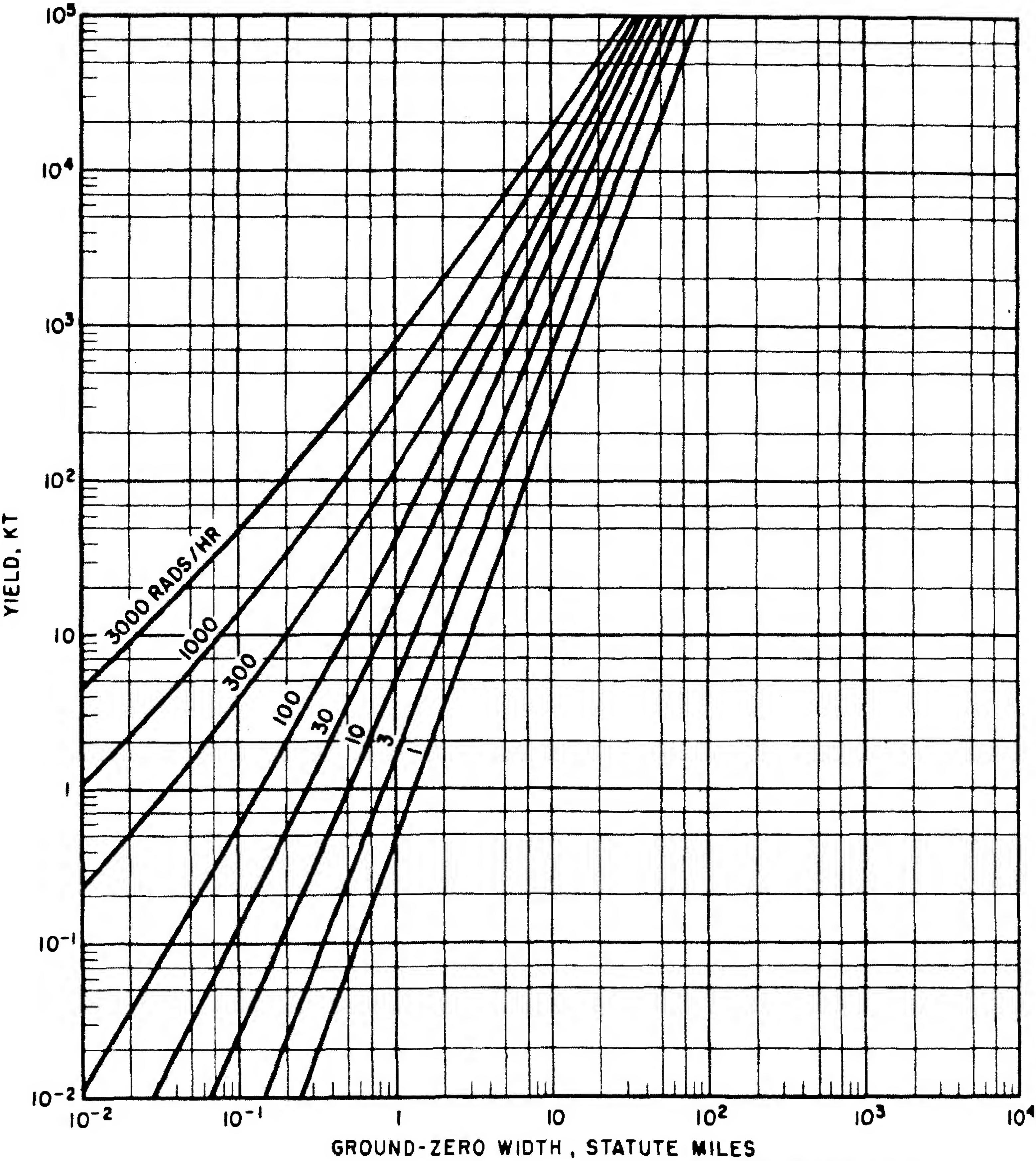


Figure 4-41. Yield vs. Ground-zero Width, 40-knot Effective Wind

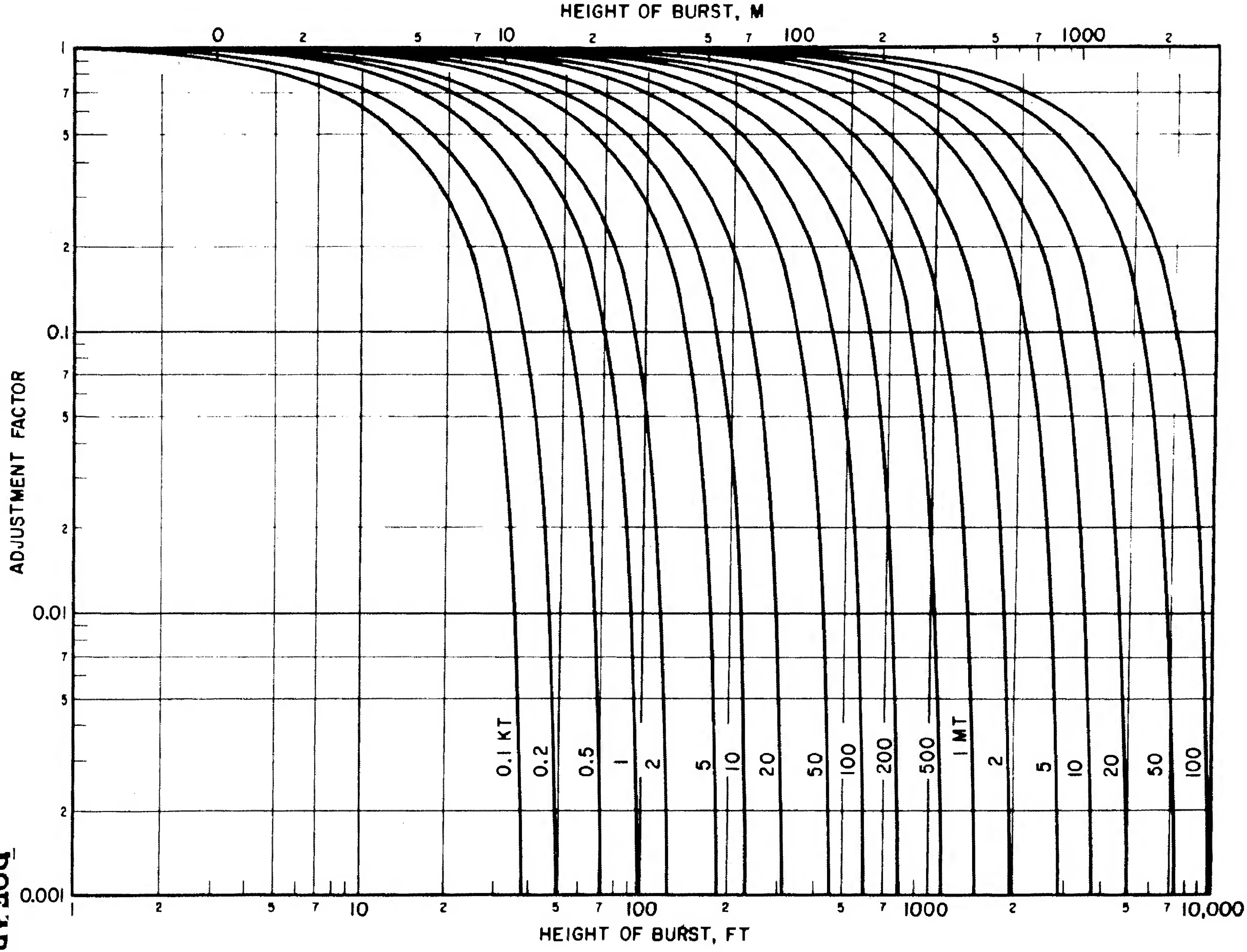


Figure 4-44. Height-of-burst Adjustment Factor for Dose-rate-contour Values Underwater Explosion, 15-knot Wind, Range of Burst Depths, 150 to 1000 ft

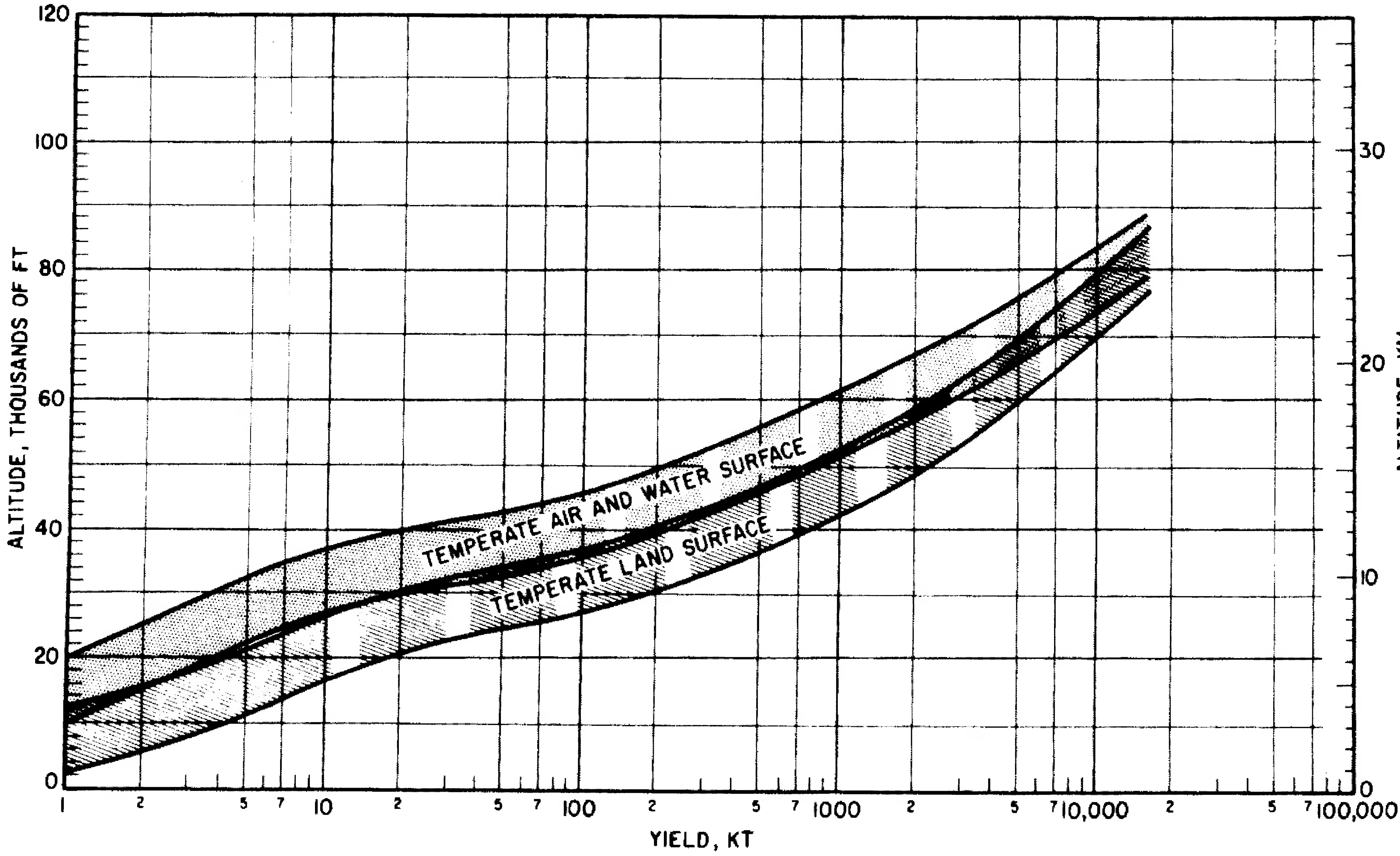


Figure 4-52. Height of Cloud Tops vs. Yield, Temperate Climates

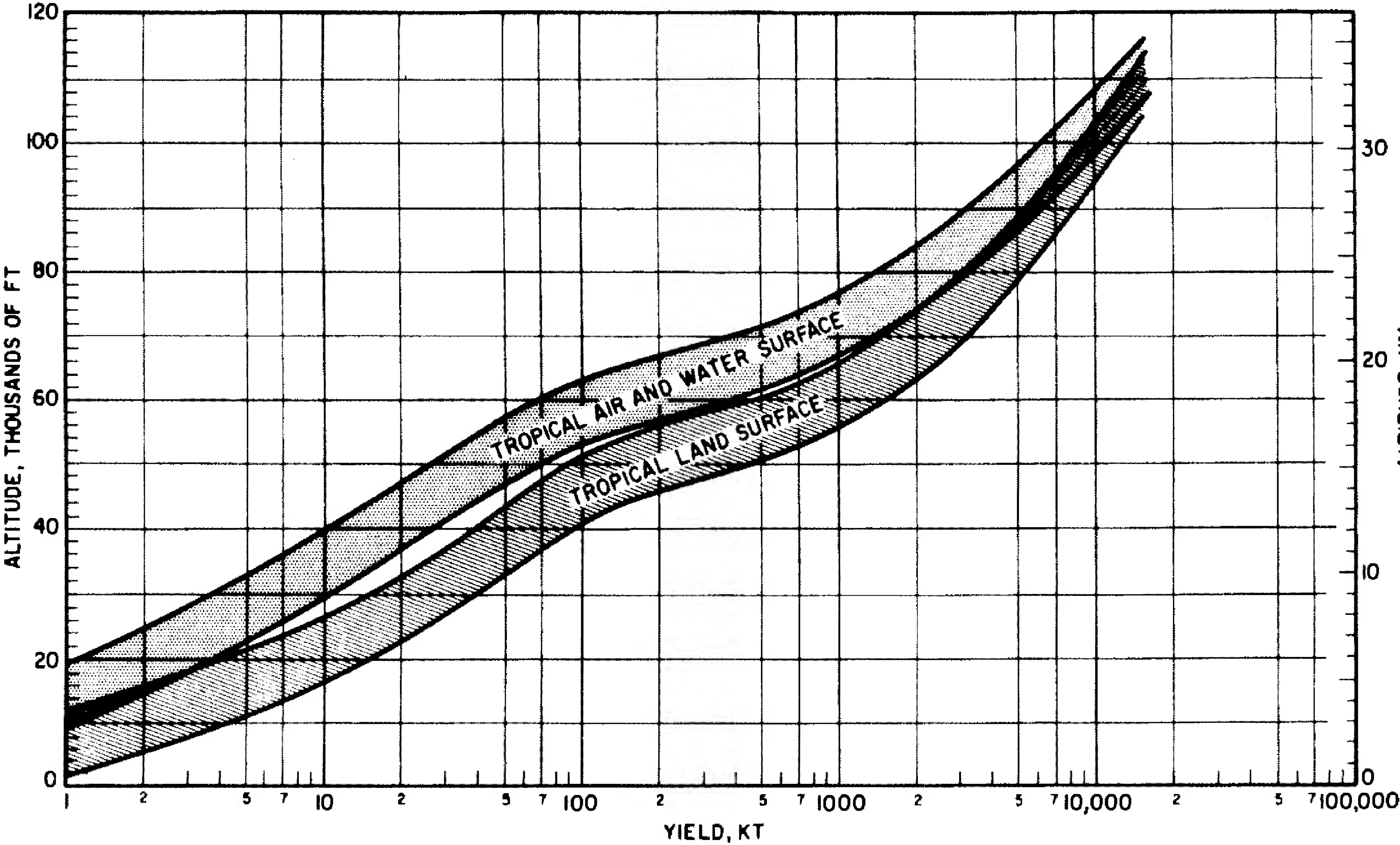


Figure 4-53. Height of Cloud Tops vs. Yield, Tropical Climates

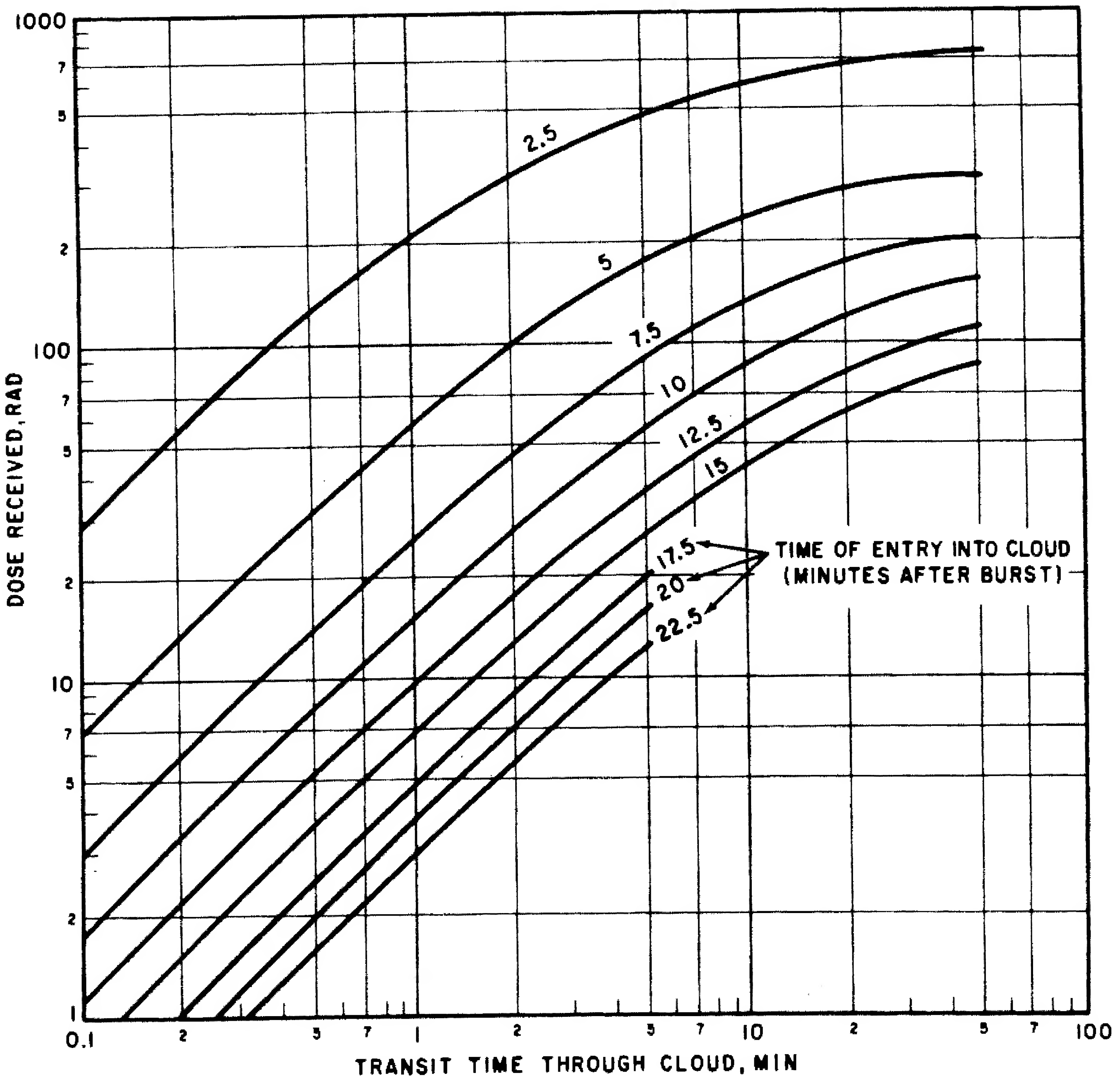


Figure 4-55. Dose Received While Flying Through a Nuclear Cloud vs. Transit Time Through Cloud

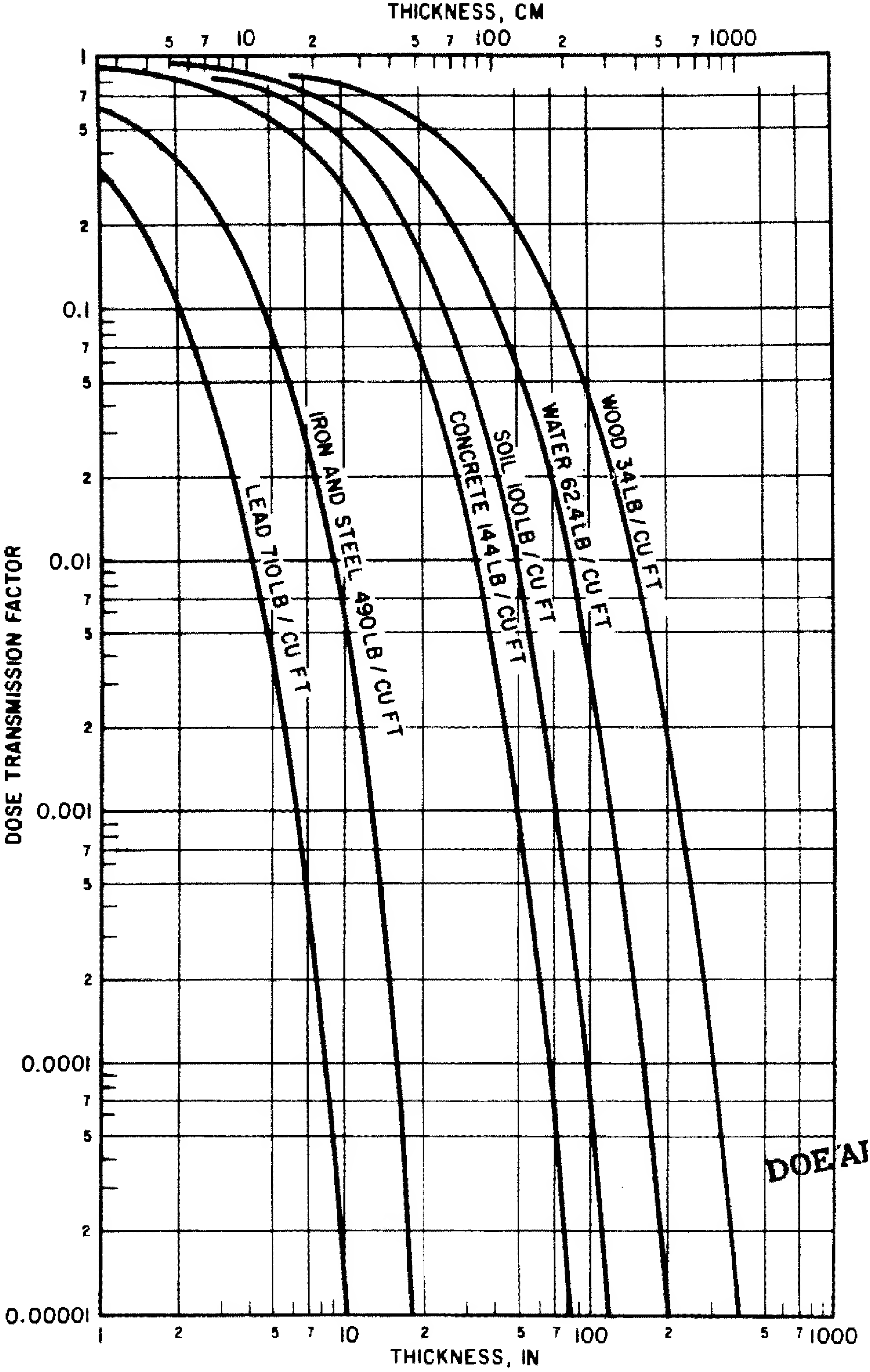


Figure 7-11. Shielding from Initial Gamma Radiation

Table 4-4 Target-burst Factors (f_{tb}) for Various Ranges of Yield and Locations of Burst and Target With Respect to Surface

Burst and Target Orientation	Air Burst Surface Target	Air Burst Air Target	Surface Burst Air Target	Surface Burst Surface Target	Sub-surface Burst Surface Target
Yield			Target-burst Factors		
Less than 400 kt	1	1.3	0.87	0.667	Obtain dose or ranges directly from figure 4-10
0.4 mt to less than 10 mt	1	1.3	1.3	1	
10 mt to 20 mt	1 (use with air-burst-surface target curves)	1.3 (use with air burst-surface target curves)	1.3 (use with surface burst-surface target curves)	1 (use with surface burst-surface target curves)	
20 mt to 40 mt	1	1.3			

Note: Extrapolation to surface burst conditions for yields greater than 20 mt and to yields above 40 mt for any burst conditions is unreliable.

Burst Location—considered an air burst when height of burst is greater than 1500 $W^{1/3}$ ft.

Target Position—considered an air target when target location is greater than 300 ft above the surface.

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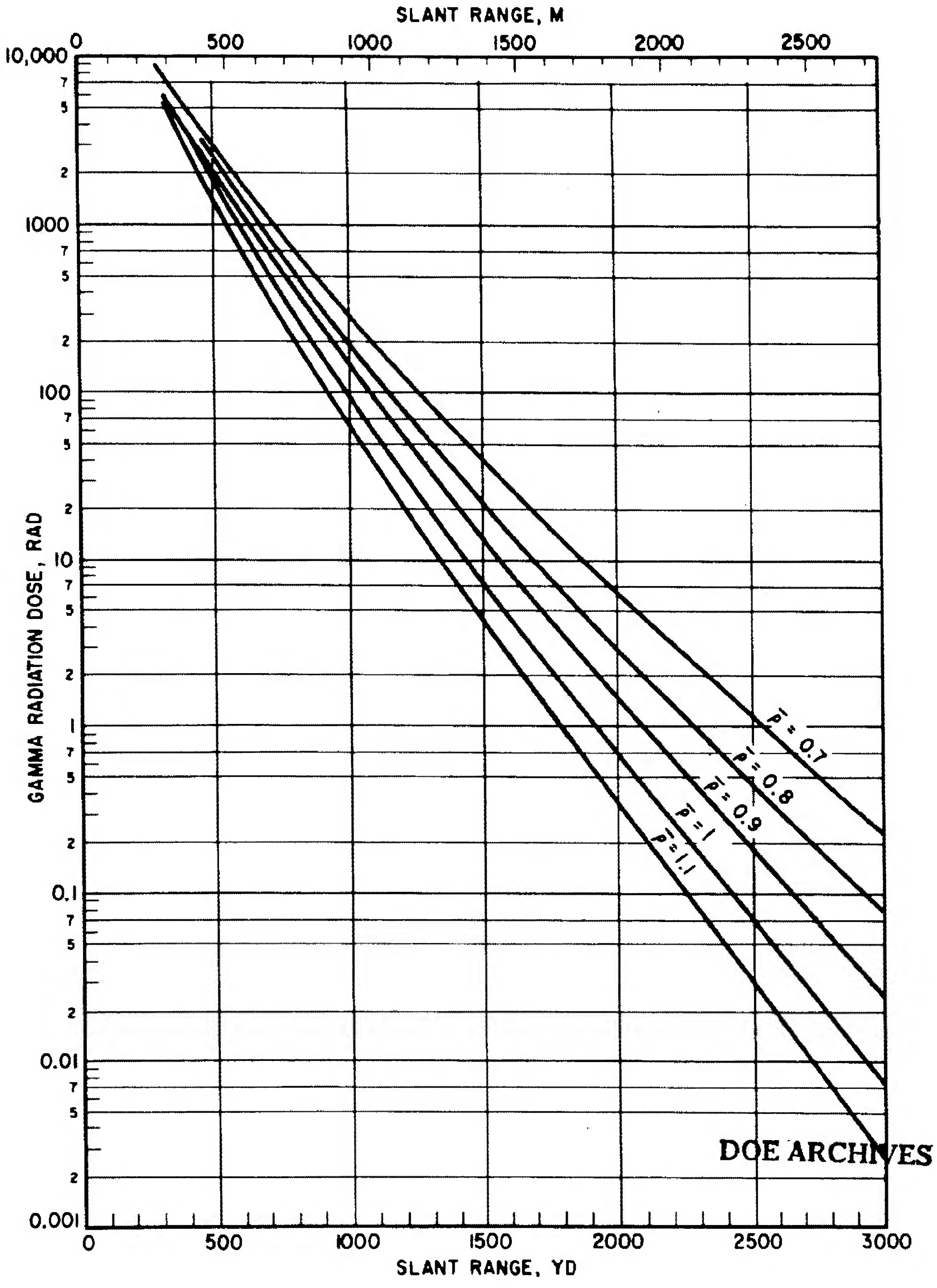

Figure 4-10. Initial Gamma Radiation Dose vs. Slant Range for Various Average Relative Air Densities, 1-kt Underground Burst, Surface Target Depth 17 ft

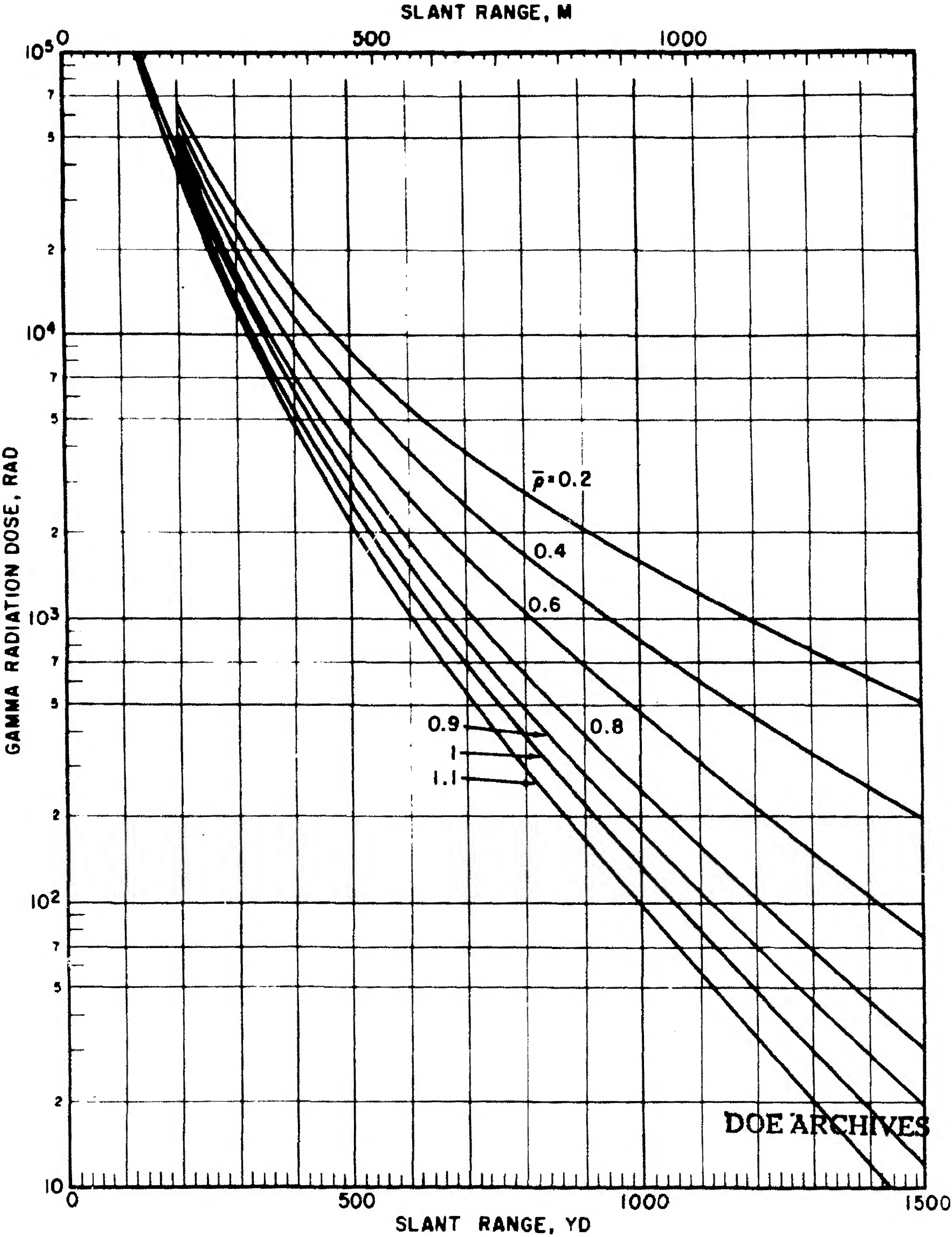

Figure 4-9(A). Initial Gamma Radiation Dose vs. Slant Range (to 1500 yd) for Various Average Relative Air Densities, 1-kt Air Burst-Surface Target

Problem 4-6 Neutron Radiation Dose

Weapon design strongly influences neutron radiation. Figures 4-17 to 4-20 are given as representative curves applicable to four general weapon categories based upon expected neutron output. Figure 4-17 applies to sub-kiloton yields and the dose is given in units of rads/ton. Figures 4-18 and 4-19 apply to average and high-flux kiloton fission weapons respectively, and the units are in rads/kt. Figure 4-20 applies to fusion weapons and the dose is given in units of rads/mt. From these curves the slant range can be determined at which a weapon of given yield will produce a specified dose; conversely, the yield required to produce a given dose at a desired range can also be found.

Several other factors will influence the dose expected at a given target location. If either the target or the burst is raised above the surface the dose can be expected to increase by approximately 50 percent. If the target is located on the water the dose can be expected to be reduced. Figures 4-17 to 4-19, curves for sub-kiloton and kiloton fission weapons, apply directly to the dose received by a land surface target from a low air burst (fireball does not touch the ground). Figure 4-20 applies directly to the dose received by a land surface target from a surface burst.

Table 4-5 Adjustment Factors for Varying Given Conditions

Condition	Factor
Target location on water surface	0.85
Target location airborne	1.5
Changing burst location from air to surface	0.67
Changing burst location from surface to air	1.5

Scaling. At a given range and relative air density, the neutron dose is proportional to weapon yield. For relative air density, see appendix B.

Example 1.

Given: A high flux 50-kt burst at 2000 ft above a water surface where the average air density between the point of burst and the target location is 0.8.

Find: The maximum neutron dose on the surface of the water at a slant range of 2200 yd.

Solution: From figure 4-19 for $\overline{\rho} = 0.8$ the dose for 1 kt at 2200 yd is 2 rads. The correction factor for the target being on water rather than on land is 0.85.

Answer: Therefore the maximum dose on the surface of the water for 50 kt at 2200-yd slant range and $\overline{\rho} = 0.8$ is $2 \times 50 \times 0.85 = 85$ rads.

Example 2.

Given: A sub-kiloton weapon burst on the ground where the relative air density is 0.9.

Find: The yield required to deliver a neutron dose of 450 rads to the outside of a bunker 500 yd from ground zero.

Solution: From the information given, figure 4-17 (sub-kiloton fission) must be used. Because the given conditions for figure 4-17 are air burst-surface target, the adjustment factor "changing burst location from air to surface—0.67" (see table 4-5) must be used to correct for a surface burst.

Answer: From figure 4-17 for $\overline{\rho} = 0.9$ read 7.2 rads/ton at 500 yd, air burst-surface target.

$$7.2 \text{ rads/ton} \times 0.67 \text{ (adjustment factor)} = 4.82 \text{ rads/ton delivered to target}$$

$$\frac{450 \text{ rads total}}{4.82 \text{ rads/ton}} = 92 \text{ tons}$$

Reliability. Depending upon weapon design, it is estimated that the dose values given in figures 4-17 through 4-20 may be low by as much as a factor of 2 for certain very high flux designs and high by as much as a factor of 5 for some older weapon designs.

Related Material. See paragraph 4-6.

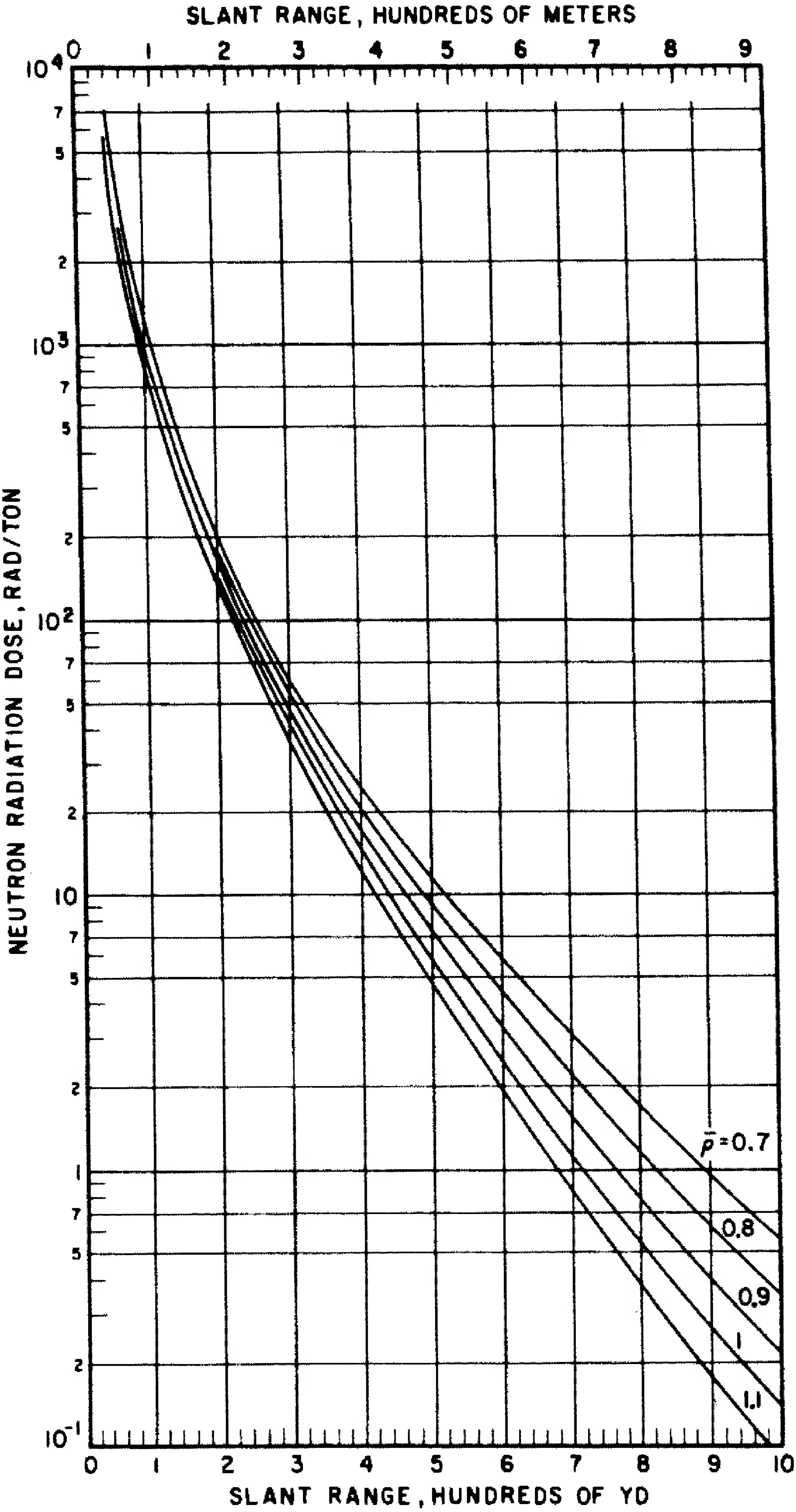

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Figure 4-17. Neutron Radiation Dose vs. Slant Range for Various Average Relative Air Densities, 1-ton (Sub-kiliton Fission) Air Burst-Surface Target

Table 4-1 Chemical Composition of Illustrative Soils

Element	Percentage of soil type (by weight)			
	Type I (Liberia, Africa)	Type II (Nevada desert)	Type III (lava, clay, Hawaii)	Type IV (beach, sand, Pensacola, Florida)
Sodium	—	1.30	0.16	0.001
Manganese	0.008	0.04	2.94	—
Aluminum	7.89	6.90	18.79	0.006
Iron	3.75	2.20	10.64	0.005
Silicon	33.10	32.00	10.23	46.65
Titanium	0.39	0.27	1.26	0.004
Calcium	0.08	2.40	0.45	—
Potassium	—	2.70	0.88	—
Hydrogen	0.39	0.70	0.94	0.001
Boron	—	—	—	0.001
Nitrogen	0.065	—	0.26	—
Sulfur	0.07	0.03	0.26	—
Magnesium	0.05	0.60	0.34	—
Chromium	—	—	0.04	—
Phosphorous	0.008	0.04	0.13	—
Carbon	3.87	—	9.36	—
Oxygen	50.33	50.82	43.32	53.332

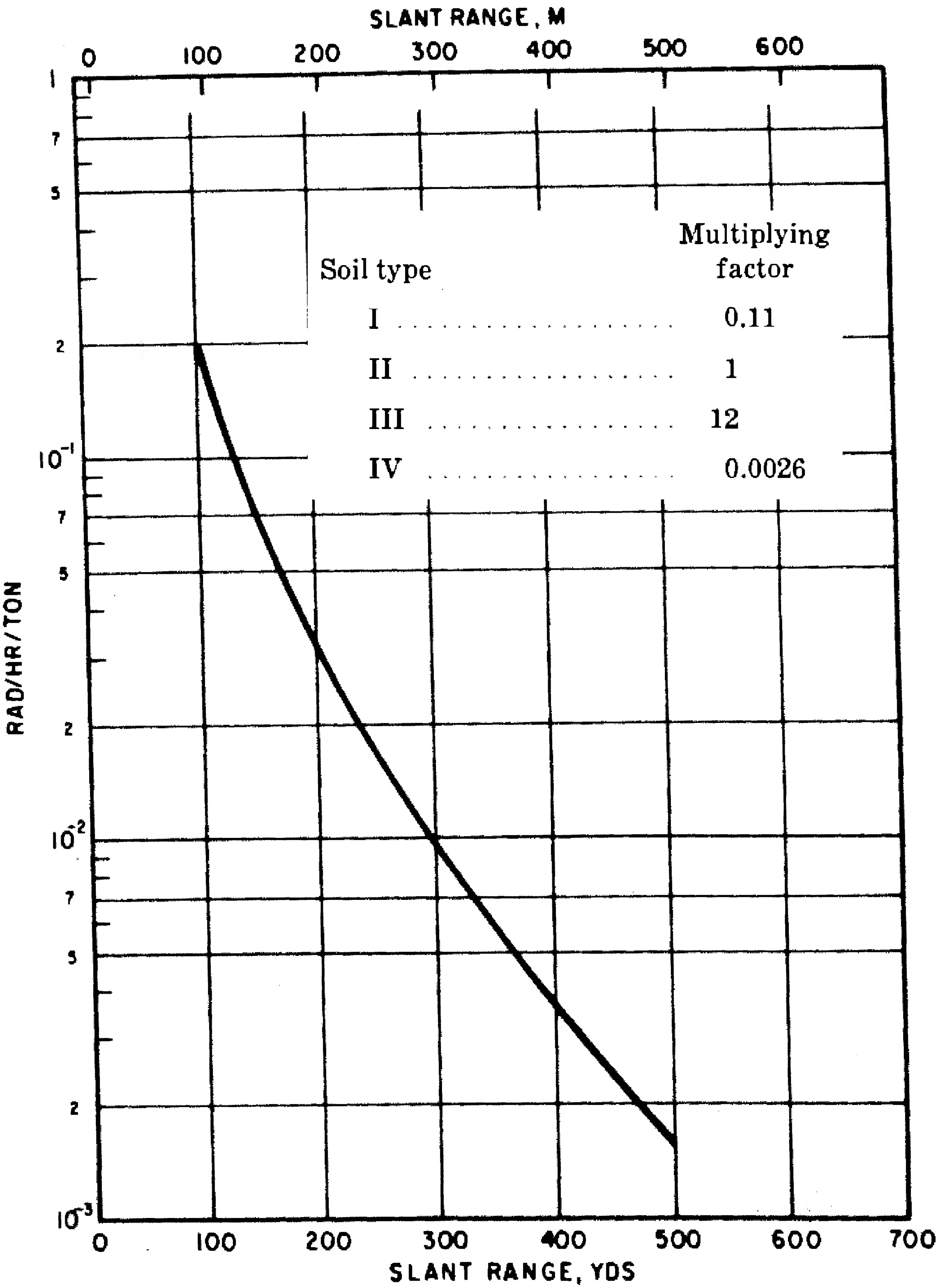


Figure 4-56. Neutron-induced Gamma Activity vs. Slant Range at a Reference Time of 1 hr After Burst, Sub-kiloton Fission Weapons per Ton

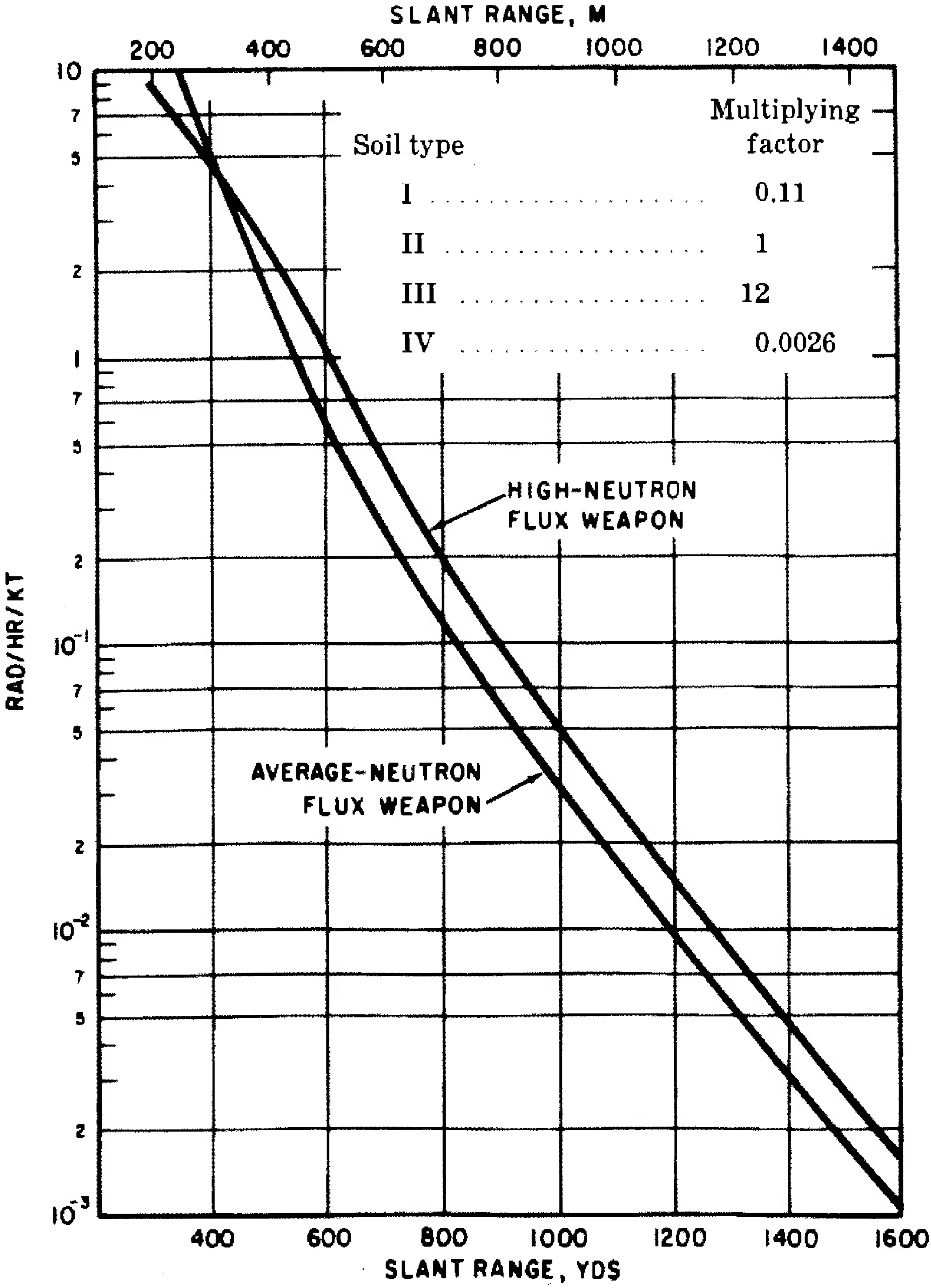


Figure 4-57. Neutron-induced Gamma Activity vs. Slant Range at a Reference Time of 1 hr After Burst, Fission Weapons per kt

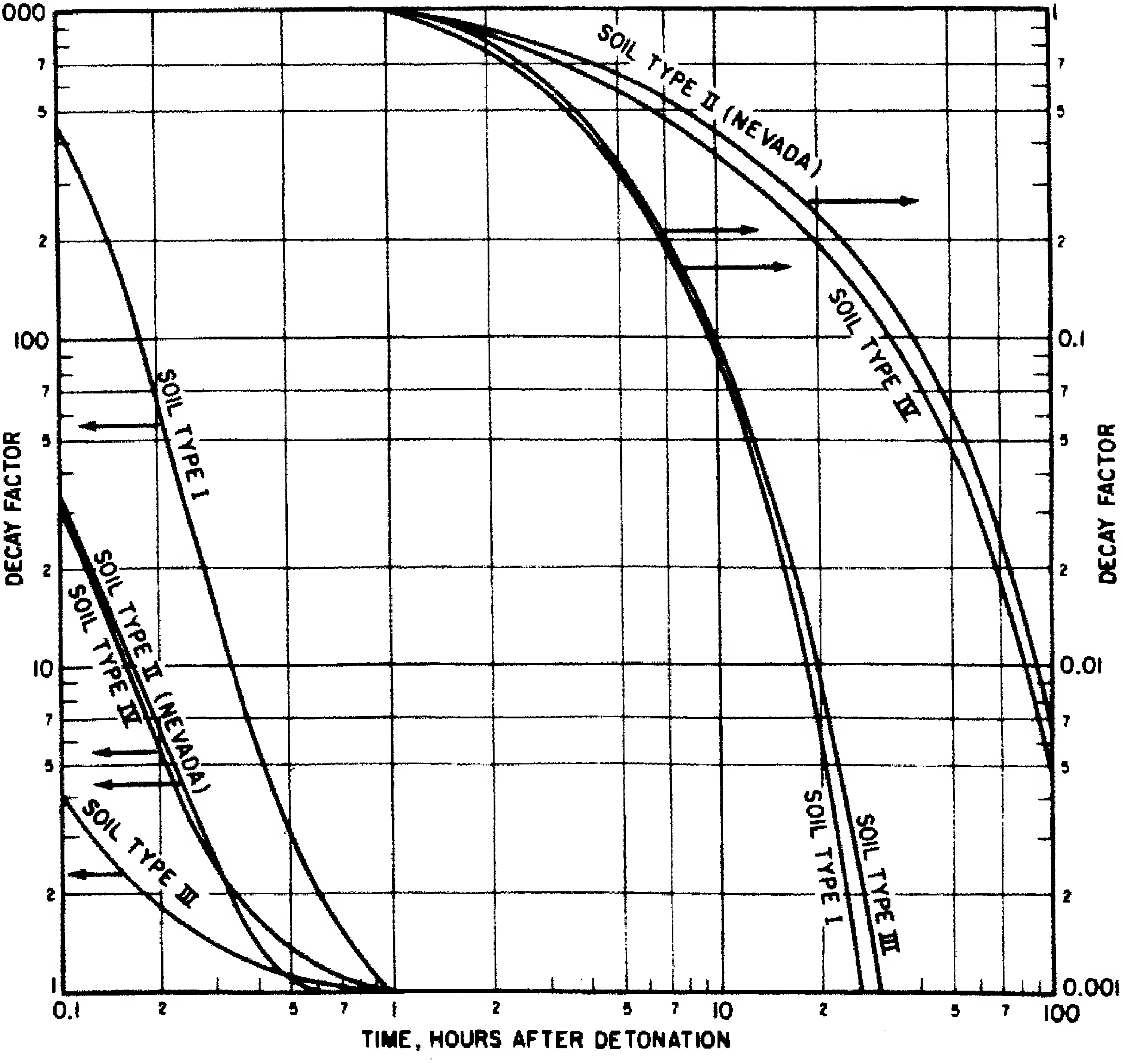


Figure 4-59. Decay Factors for Neutron-induced Gamma Activity

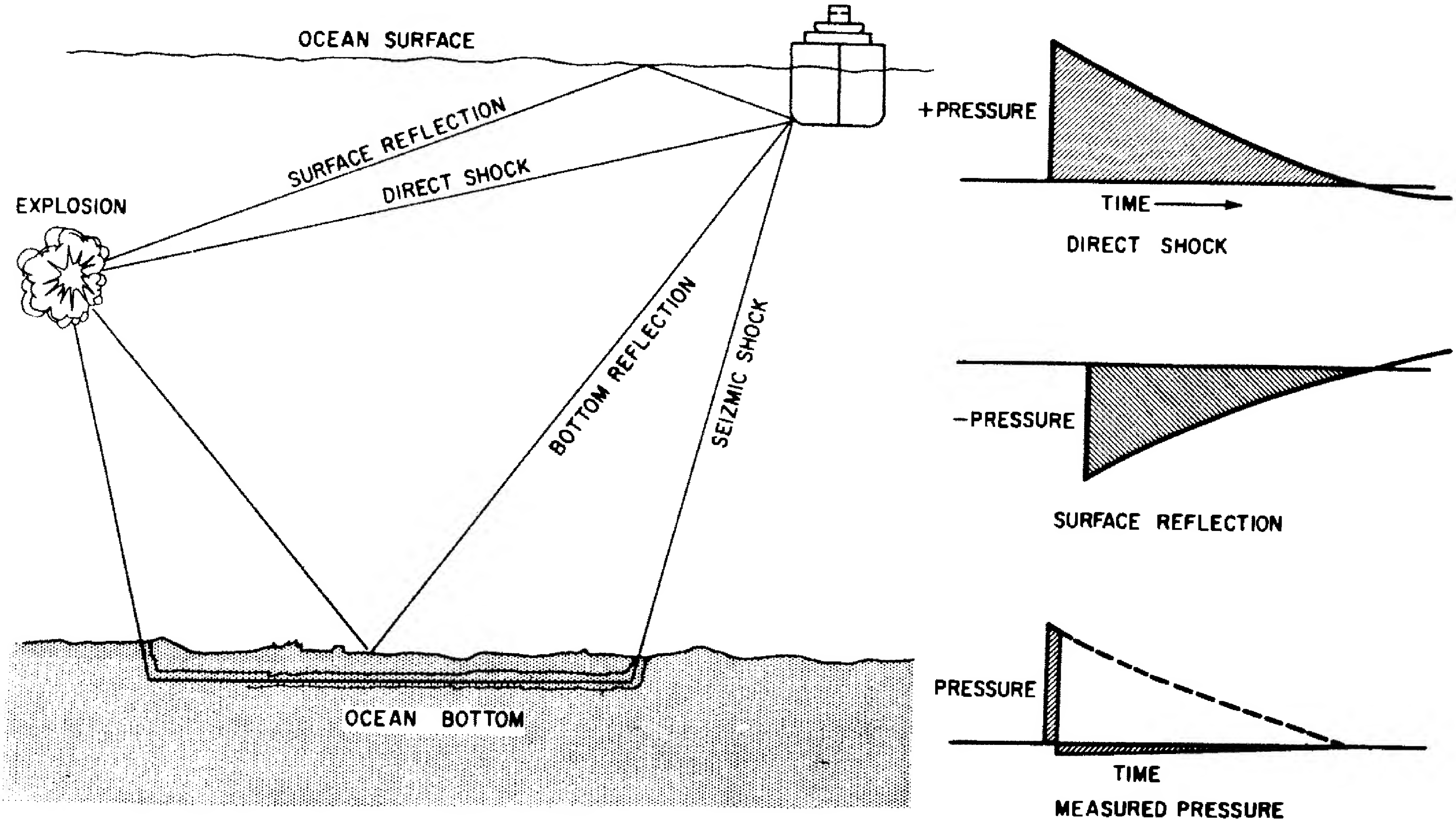


Figure 6-2. Direct and Reflected Shock Waves from an Underwater Burst

DO

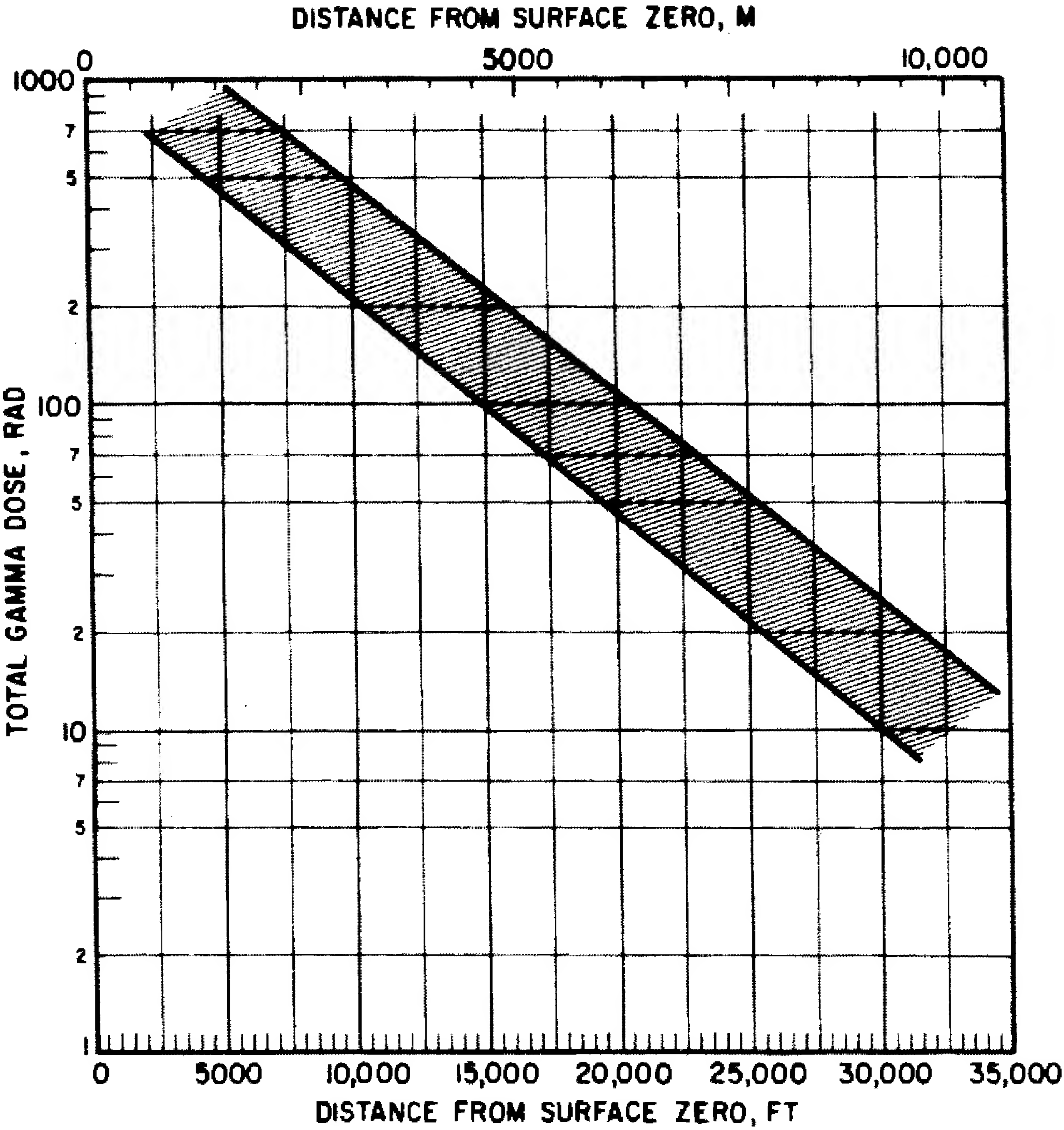


Figure 4-49. Total Dose at the Surface Downwind from a 10-kt Underwater Explosion, 15-knot Wind, Range of Burst Depths, 150 to 1000 ft

some fission products are lost along the path of migration to the surrounding water.

4-28 Fractionation. The radioactive material carried by the base surge, in most cases, fractionates in favor of those fission products having rare-gas ancestors. This probably results from scavenging of the more-refractory fission products by the early subsiding masses of water from the columns of plumes, thereby returning them to the ocean in the immediate vicinity of surface zero.

4-29 Time-space History of the Above-surface Radiation Fields. For all types of underwater explosions, the major source of radiation, to the observer on the surface, is probably the base surge, which can be extremely dangerous to any station it engulfs. Although the total quantity of fission products within the base surge amounts to some 10 to 30 percent of that initially formed, the specific activity is very high because of the early age of the radioactivity. It should be emphasized that *very close* to subsiding columns or plumes, the base surge deposits significant amounts of radioactive material on the surface causing a temporary radiological hazard. The phenomenon is almost entirely transient in nature, similar to being engulfed by a heavy fog.

Evidence to date suggests some distinct differences in the geometry of the base surge depending on whether the explosion is shallow (columns) or deep (plumes). In either case the resulting surge expands radially at a high velocity, and takes the form of a toroid for shallow explosions and is more like concentric multiple toroids for deep explosions. These differences in geometry have two effects on the time-space history of the radiation: as the single toroid passes over a station, the dose rate and dose are delivered in two increments (the forward and rear actions of the ring), as seen in figure 4-6; where concentric multiple toroids are formed, as is the case for the deep explosion, the radiation is delivered over one broad continuous increment, as shown in figure 4-7. The time of passage depends on the maximum extent of the surge periphery, the location of the observer, and the wind speed.

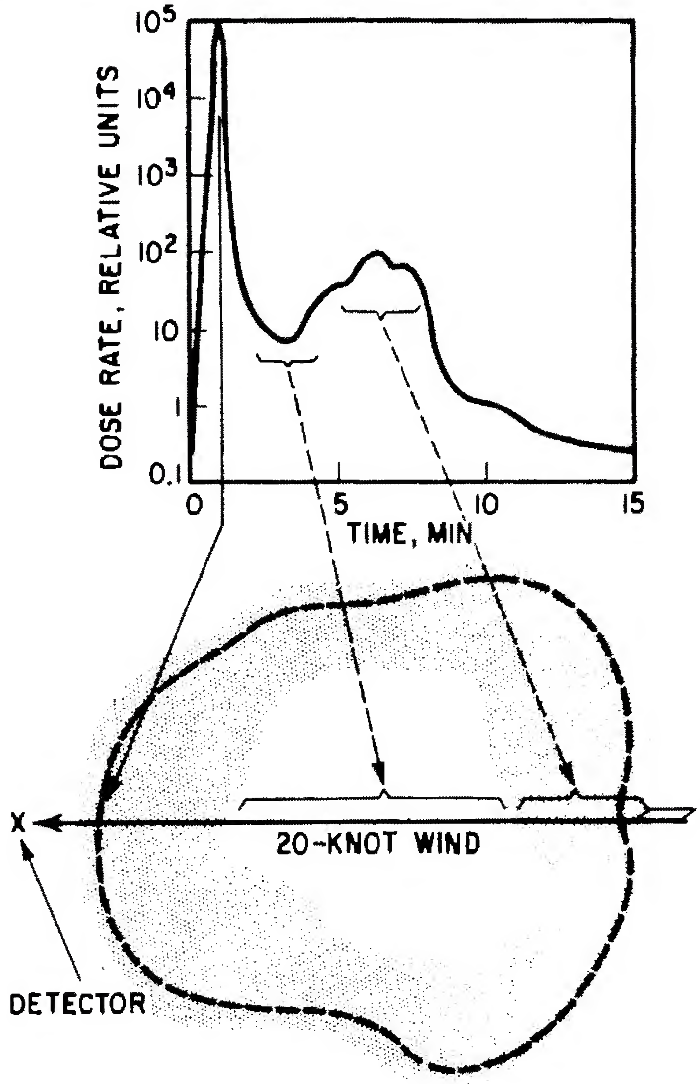


Figure 4-6. Dose Rate vs. Time for a Shallow Underwater Burst

4-30 Water Surface Shot. Nominal-yield bursts on the surface of deep water will resemble the very shallow detonation with the addition of some prompt gamma and neutron activated nitrogen in the atmosphere. For high yields such as a megaton surface burst over shallow water (less than 200 ft deep) the above-surface effects will be similar to those of a land detonation, with the cloud rising to greater heights. Probably, no base surge will develop, but the fallout likely will be different from a land surface burst, and the area of militarily significant fallout will probably be smaller. If the yield is large enough for the cloud to reach the tropopause, the cloud upon reaching this level will rise more slowly and increase in lateral dimensions more rapidly as though flattening out against a ceiling. After reaching maximum altitude, the diameter slowly increases as the cloud drifts downwind. Figure

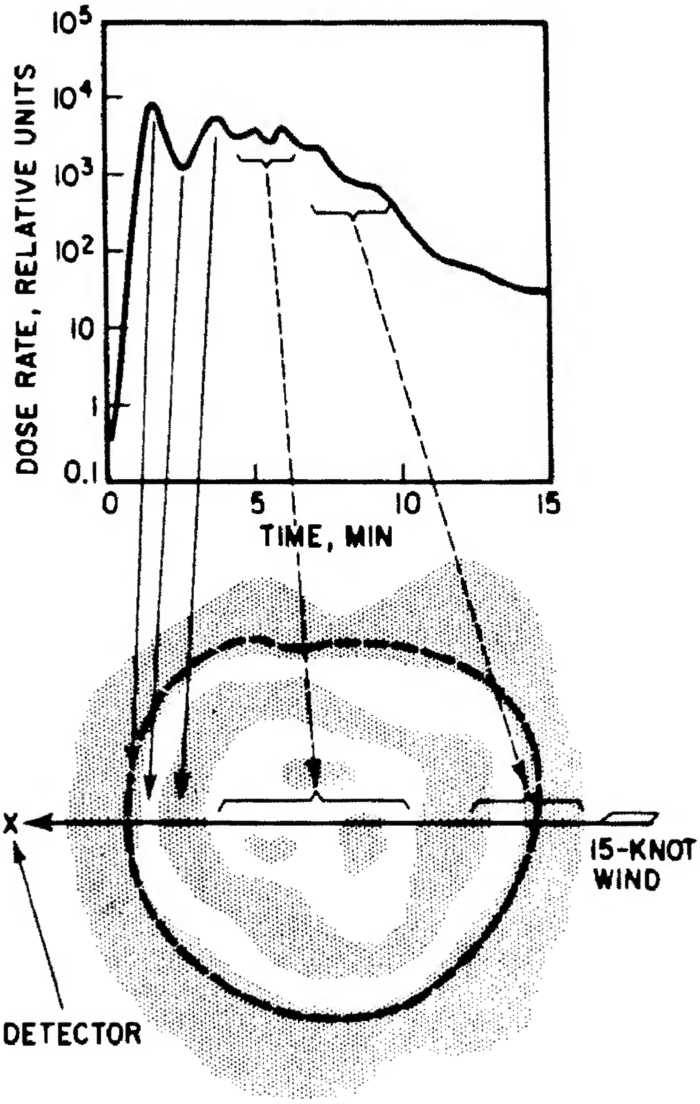


Figure 4-7. Dose Rate vs. Time for a Deep Underwater Burst

4-54 shows the cloud diameter-versus-time relationships. Figure 4-55 gives the dose received by personnel in aircraft flying through an atomic cloud at various times after the detonation.

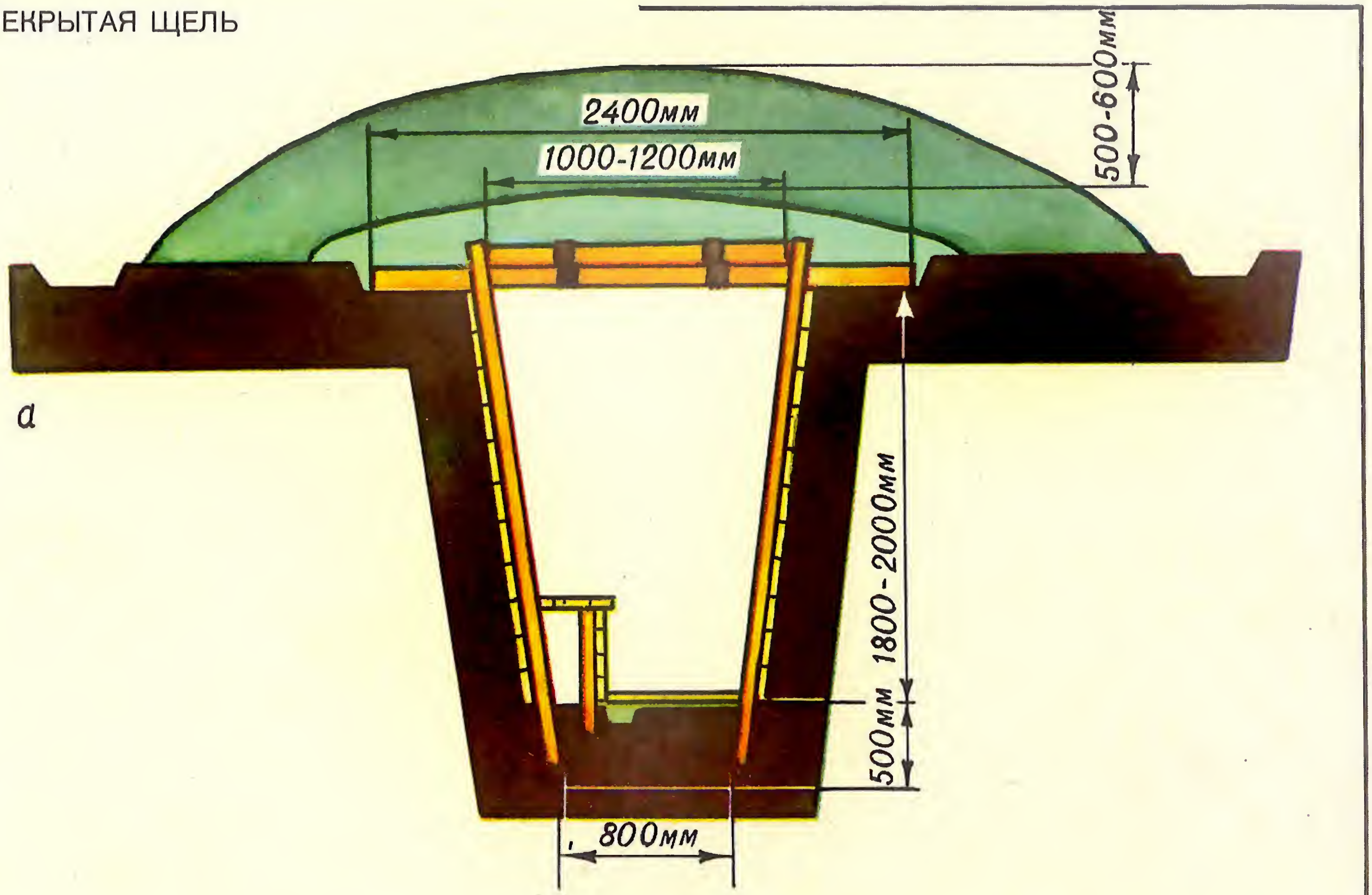
RESIDUAL BETA RADIATION

In general, the hazard due to residual gamma radiation exceeds the beta hazard for all cases except those in which intimate contact with beta-active materials occurs, as when an individual lies prone in a contaminated area, or when particles fall out directly upon the skin or scalp. For such cases, superficial burns may result, as discussed in paragraph 7-21.

SHIELDING

The dose rates obtained from the contours described, and the total doses derived therefrom, are free-field values that must be reduced if the individual concerned is protected by some shelter. Shielding factors can be estimated from the considerations stated in paragraphs 7-26 through 7-28. For example, personnel in the open in a built-up city area would receive 0.7 of the free-field dose, whereas personnel in shelter such as the basement of a dwelling would receive about 0.1 of the free-field dose.

ПЕРЕКРЫТАЯ ЩЕЛЬ



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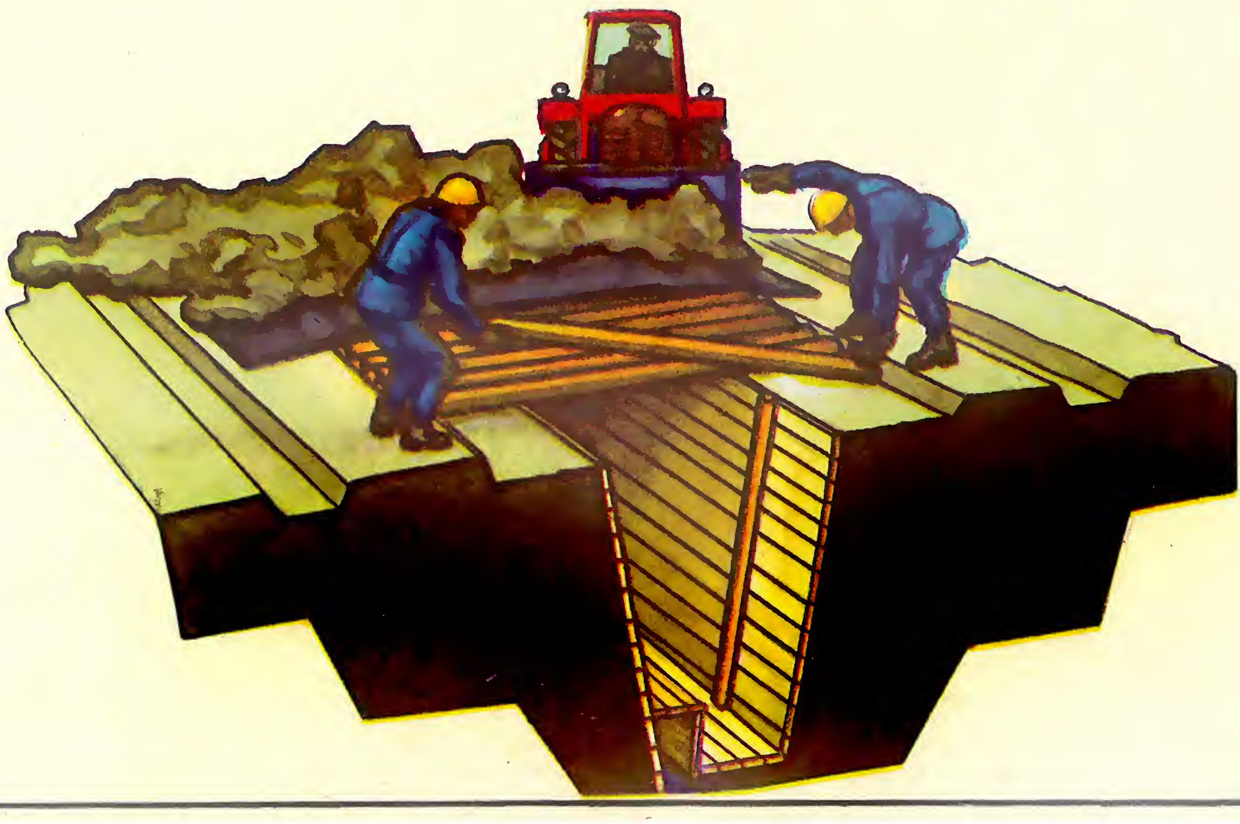


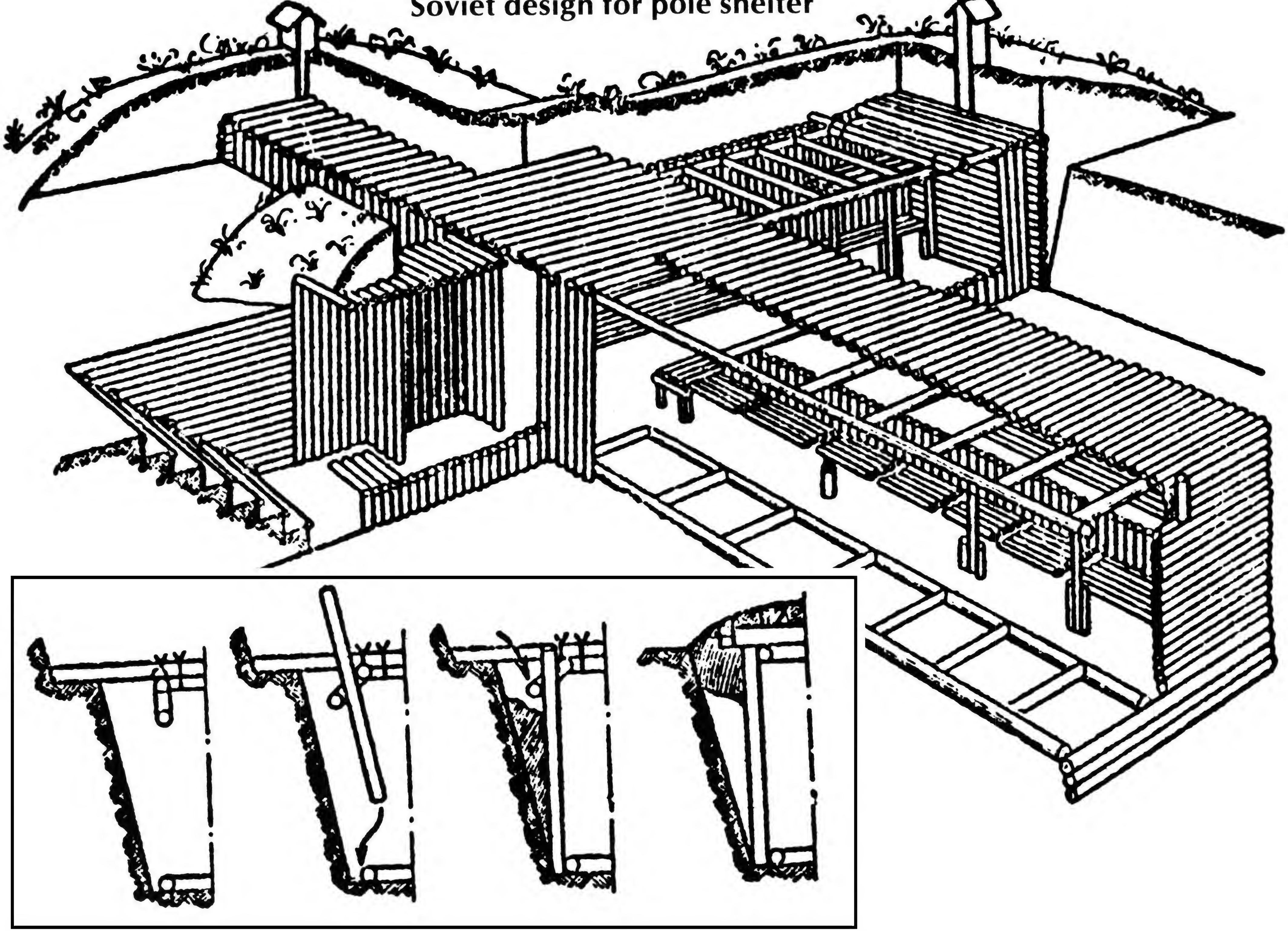
б

Russian nerve gas atropine injection

Russian civil defence drill

RUSSIAN CIVIL DEFENCE: GAS MASKS, RESCUE TEAMS, BASEMENT SHELTERS AND EVACUATION

Soviet design for pole shelter



MILITARY ASPECTS AND IMPLICATIONS OF NUCLEAR TEST BAN PROPOSALS AND RELATED MATTERS

HEARINGS

BEFORE THE

PREPAREDNESS INVESTIGATING SUBCOMMITTEE

OF THE

COMMITTEE ON ARMED SERVICES UNITED STATES SENATE

EIGHTY-EIGHTH CONGRESS

FIRST SESSION

PART 1

MAY 7, 15, 28; JUNE 5, 25, 26, 27; AUGUST 1, 2, AND 9, 1963

Printed for the use of the Committee on Armed Services

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which this testing has been done concurrently overseas and within the United States. The first events commenced and completed were underground tests. These consisted of, as you can see here, the Hard Hat event, the Danny Boy shot, and Operation Marshmallow.

In addition, the other four events which occurred at the Nevada test site—The Little Feller II shot—the Danny Boy test, which is a crater and ground shot experiment, the Small Boy test, which comprised a great number of projects which I will go into more detail a little later, and, finally, the Little Feller I shot [deleted].

I will attempt to provide a synopsis of the most significant results of these tests, in terms of the requirements we have previously stated.

The five shots that occurred in the Pacific in the effects area were all high altitude. We did one underwater test which was to evaluate underwater effects for the safe delivery or safe standoff distance for delivery systems in delivering nuclear weapons.

CONTINENTAL TESTS

Test	Purpose	Yield (kilotons)	Date
Underground:			
Hard Hat	Underground structures	5.9	Feb. 15, 1962
Danny Boy	Cratering	.43	Mar. 5, 1962
Marshmallow	[Deleted]	[Deleted]	June 28, 1962
Atmospheric:			
Little Feller II	[Deleted] effects	[Deleted]	July 7, 1962
Johnie Boy	Cratering	.5	July 11, 1962
Small Boy	[Deleted]	[Deleted]	July 14, 1962
Little Feller I	[Deleted] effects	[Deleted]	July 17, 1962

PACIFIC TESTS

High altitude:			
Star Fish	400 kilometer effects	1,450	July 9, 1962
Check Mate	[Deleted] effects	[Deleted]	Oct. 20, 1962
Blue Gill	[Deleted] effects	[Deleted]	Oct. 26, 1962
King Fish	[Deleted] effects	[Deleted]	Nov. 1, 1962
Tight Rope	[Deleted] effects	[Deleted]	Nov. 4, 1962
Underwater: Sword Fish	Underwater effects	13.5 CLASSIFIED IN 2015!	May 11, 1962

DEFINITION OF HIGH ALTITUDE

Senator SALTONSTALL. High altitude is about how high?

Colonel CLINTON. We usually think of high altitude being anything above the altitude normally associated with airplane flight, sir.

Most of our high-altitude shots have been from 20 kilometers on up. We have done some lower altitude shots that have been in the atmosphere, which we have done by balloons. We generally think of high-altitude tests as being those tests above manned aircraft.

Senator THURMOND. What elevation is that, Colonel?

Colonel CLINTON. Fifty thousand feet, sir, on down. Normally I would say we would think of anything above 50,000 feet—I believe we would consider that a high-altitude shot.

Senator STENNIS. All right, proceed.

Colonel CLINTON. I will attempt to discuss some of the results which we obtained from the tests in the last series.

The first of these is the vulnerability of hardened sites to both blast and shock effects [deleted]. These are the [deleted] major phenomena to which are hardened sites [deleted] are vulnerable. [Deleted]

Yesterday, as you know, we had Admiral Anderson before us. He presented the statement that represents the joint views of the members of the Joint Chiefs.

I nevertheless think that it is important for you to testify personally in addition thereto.

You refer to the views expressed in the joint statement, and you concurred in that statement, is that right?

TESTIMONY OF GEN. CURTIS E. LeMAY, CHIEF OF STAFF, U.S. AIR FORCE; COL. OLA P. THORNE, ASSISTANT FOR NUCLEAR ENERGY TO THE DEPUTY CHIEF OF STAFF, RESEARCH AND DEVELOPMENT, U.S. AIR FORCE; FRANK H. PEREZ, CONSULTANT ON ATOMIC ENERGY MATTERS TO THE ASSISTANT CHIEF OF STAFF, INTELLIGENCE, U.S. AIR FORCE, ALSO AIR FORCE MEMBER OF THE JOINT ATOMIC ENERGY INTELLIGENCE COMMITTEE; AND LT. COL. CHESTER A. SKELTON, ARMS POLICY BRANCH, DEPUTY CHIEF OF STAFF, PLANS AND OPERATIONS, U.S. AIR FORCE

General LEMAY. Yes, sir; that is right.

Senator STENNIS. You have filed a very strong supplementary statement. I believe it will expedite the matter if we can let the general read his statement now and read it in its entirety. Then we can ask questions.

All right, General, will you proceed in your own way?

LE MAY STATEMENT

General LEMAY. Mr. Chairman and members of the committee, the views of the members of the Joint Chiefs of Staff on a proposed nuclear test ban treaty were presented by Admiral Anderson on June 26, 1963. The agreed joint statement was submitted for the record .

I shall not elaborate further on the views presented in the agreed statement. However, I should like to repeat for emphasis that it is the judgment of the Joint Chiefs of Staff that the proposed test ban treaty is not adequate to prevent the Soviet Union from making important advances in nuclear weaponry [deleted]. We have concluded that the proposed treaty is not consistent with the national security.

At this time I should like the opportunity to discuss with you my views on the military implications of a nuclear test ban. [Deleted.]

If we expect to maintain military superiority, as the situation exists today, we must do two things: (1) continue to expand our understanding of weapon effects, and (2) continue to improve our military capabilities through the development and application of new weapon techniques. Nuclear testing is necessary for both of these objectives. To put it in another way: continuing, substantial progress in our nuclear technology is essential if we are to maintain the military capability necessary to support our overall foreign policy objectives. Testing is essential for such progress.

Some advance in nuclear technology can be made without testing, but the rate is unacceptably slow. This fact was brought home to us solidly by the 1958, self-imposed moratorium. We attempted to maintain our laboratories at a readiness-to-test capability; and we dis-

At sea level, the radiation dose from cosmic radiation far exceeds that from fallout; at higher elevations (Denver, Colo., 5,000 feet), cosmic radiation contributes an even greater fraction of the total body dose.

Fear of the unknown is played up by cartoons, propaganda, half-truths and misinformation as to the effects of fallout. I do not wish to imply that fallout cannot be a hazard; however, with proper precautions, such as those taken by the AEC, the hazard is minimized. A good public information program could allay most of the present concern. It is clear that effects from fallout are far less dangerous to our people, and the people of the free world, than the risks of Russian predominance in the nuclear weapons field.

Unless we are willing to undertake our testing program enthusiastically, and to expend the necessary effort and resources to insure a positive U.S. superiority in all of the critical nuclear areas, the Soviets stand to gain a clear margin of nuclear superiority vis-a-vis the United States. In the current world environment, preserving peace means maintaining preponderant military power. To maintain a favorable balance of military power we must have nuclear superiority. To do this I firmly believe we must continue our nuclear weapon development programs and be able to conduct nuclear testing as required.

WHETHER TESTING IS NECESSARY TO MAINTAIN U.S. SUPERIORITY

Senator STENNIS. General, may I ask a few questions now based on your supplemental statement?

In the first part of your statement you say, and I am paraphrasing, that testing is essential for progress; and testing is also necessary to maintain our military superiority.

Now my question is this: Is this still true even if Russia should, under agreement, actually stop testing?

Suppose there should be a treaty and it should be observed and Russia actually stopped testing. Would our position then become inferior? Would parity result or would your statement hold true if there should be agreement?

General LEMAY. If both sides agreed to stop testing now, and the Russians abided by the agreement, they would certainly be ahead of us in the high-yield weapons. We are sure of that.

They are probably ahead of us in the [deleted] range. [Deleted.]

While there seems to be general agreement [deleted] that we are probably still ahead in the low-yield range, I am not so sure that we have enough information to support this view.

It seems to me that at the time the Soviets decided to go ahead with their very comprehensive test program, they probably planned to test across the spectrum. They may have concentrated on high-yield tests; however, I believe it is prudent to assume that they went clear across the spectrum of yields. [Deleted.]

Senator STENNIS. So, regardless of the situation at the lower yields, you feel sure that from [deleted] upward they have a present superiority which, of course, they would maintain if all testing were stopped by both sides, is that correct?

General LEMAY. I think that is correct; yes, sir.

TOP SECRET

B. F. with other Min
11/3

R 5th March, 1953.

Dear Montague-Browne,

With reference to my letter of 4th March about the article in the Daily Telegraph on searching of ships for atomic bombs, my attention has now been called to the fact that Sir Norman Brook sent a minute to the Prime Minister on this subject dated 28th March 1952, enclosing a copy of a paper headed "Clandestine Use of Atomic Weapons".

I had not realised when I wrote to you that Sir Norman Brook had been handling this question. I suggest that in the circumstances it would be better not to put my letter to the Prime Minister until Brook has has had an opportunity of considering the matter further in the light of recent developments. I will let you know as soon as I can whether or not we would like the letter to go forward.

Yours sincerely,

[signature]

Sir N. Brook's minute now submitted.

AMB
10/3

A.A.D. Montague-Browne, Esq., D.F.C.

TOP SECRET

PRIME MINISTER

You have drawn the attention of the Ministry of Defence to an article about Atom Bomb Checks by American Coast Guards, which appeared in the Daily Telegraph on February 27. — flag A

flag 'B'

I made a submission to you on this subject on March 28, 1952, when I sent you a copy of a minute which I had sent to Mr. Attlee in July, 1951. I said then that I believed the risk that an enemy might explode an atomic bomb in a ship in one of our ports was one against which we could not at present take any effective precautions. Recently, however, we have heard that the Belgians and the Dutch - as well as the Americans - are claiming to have introduced precautions of some sort. We are now finding out more about these; and, when this information is available, I will make a further submission to you on the question whether we should review our own position again.

Duplicate noted and returned.

12/3.

12.3

Norman Brook.

MARCH 9, 1953

R.

EXTRACT FROM "THE DAILY TELEGRAPH"

27/2/53. page 7:

ATOM BOMB CHECKS
1,500 Ships Searched

Rear-Adml. Richmond, Assistant Commandant of the Coast Guard Service, revealed to-day that Coast Guards were regularly searching vessels approaching ports such as New York for atomic bombs, other types of explosive and bacteriological weapons. More than 1,500 ships had been searched during the past two years.

At present 30-40 vessels are being searched monthly, most of them from Iron Curtain countries. "So far," added the Admiral, "we have found nothing that resembled explosive."

Tube Alloys
Clandestine use of weapon
Part 2

G.R. TOP SECRET

PRIME MINISTER

At the "Apex" Committee on Wednesday you asked me to let you have a report on the risk that an enemy might explode an atomic bomb in a ship in one of our ports and on difficulties of countering this risk.

I attach the report below on this question which I submitted to Mr. Attlee in July, 1951. As you will see, the Chiefs of Staff had then asked me to arrange to have the matter further considered by the civil Departments concerned; but I had come to the conclusion that matters could not be advanced further by this means and I suggested that Mr. Attlee should discuss the problem with the Foreign Secretary and the Minister of Defence. This he was unable to do before the Election. Since then I have taken no further initiative to raise the matter since I myself believe that this is a risk against which we cannot at present take, in normal times, any effective precautions.

Norman Brook.

R. 28th March, 1952

TOP SECRET

PRIME MINISTER

Clandestine Use of Atomic Weapons

The Chiefs of Staff have been considering the possibility that the enemy might open the next war with an atomic attack on London on the model of the Japanese attack on Pearl Harbour - without warning and before any formal declaration of hostilities. The most effective method of making such an attack would be to drop an atomic bomb from a military aircraft. If the control and reporting system were fully manned and alert in a period of tension, there would be some chance that hostile aircraft approaching this country could be intercepted and driven off. At any rate, there are no special measures, outside the normal measures of air defence, which we could take in peace-time to guard against this type of attack.

2. It is, however, possible that the enemy might use other means of surprise attack with atomic weapons. A clandestine attack could be made in either of the following ways:-

(i) A complete atomic bomb could be concealed in the hold of a merchant ship coming from the Soviet Union or a satellite country to a port in the United Kingdom:

(ii) An atomic bomb might be broken down into a number of parts and introduced into this country in about fifty small packages of moderate weight. None of these packages could be detected by instruments as containing anything dangerous or explosive, and even visual inspection of the contents of the packages would not make identification certain. These packages could be introduced either as ordinary merchandise from Soviet ships, or possibly as diplomatic freight. The bomb could subsequently be assembled in any premises with the sort of equipment usual in a small garage, provided that a small team of skilled fitters was available to do the job.

3. It is difficult at any time to take practical and effective measures against this type of danger. It would be less difficult, of course, in a period immediately before the outbreak of a war which the

public had come to regard as inevitable - the period which we call the Precautionary Stage. But the enemy might prefer to make such a move in a period of comparative calm, when he might assume that less attention would be paid to security risks of this kind.

The only possible measures which could be taken to reduce this risk are control of shipping and closer supervision of diplomatic freight.

Control of Shipping

4. For effective security against this risk all suspect shipping would have to be kept at least 5,000 yards distant from any worth-while target - e.g. from London, Liverpool, Glasgow, Southampton, Bristol and Hull. There are in theory four possible ways of doing this:-

(a) Trade Attraction. All Russian ships carrying bulk cargoes on Government account could be diverted to minor ports, by specifying that that was where the consignee desired delivery of the goods. This would be regarded as discrimination against Russian ships and would invite inconvenient reprisals. It would be expensive. And it would not cover Russian ships carrying cargo ordered on private account.

(b) Diversion by Order. The Admiralty could take power to regulate the movements of all vessels, as they had in the war under Defence Regulation 43. They could then divert all ships of any kind suspected of carrying Russian cargo to minor ports. By a liberal use of this power, the diversion could be made effective; but the discrimination against Russian and satellite shipping would be so blatant that it might well end in the complete stoppage of all trade with the Iron Curtain countries.

(c) Off-shore Discharge. All Russian, Polish and Roumanian ships approaching the major ports could be instructed to discharge their cargoes at off-shore anchorages. This method would lead to retaliation. Moreover, it is hardly practicable; for grain is the main commodity carried by Russian ships and we do not possess the floating elevators which would be necessary for off-shore discharge of grain cargoes at all major ports.

(d) Port and Transit Control. In the Precautionary Stage we propose to introduce a scheme by which all ships approaching the country would be met and escorted to determined ports and anchorages. Under this control

suspect ships could be diverted away from the main target areas; but the control would only be practicable in the Precautionary Stage when there would be a much reduced volume of United Kingdom and Allied shipping, and enemy shipping would be likely to keep as far away as possible from United Kingdom ports. It would be impracticable to bring this system into force at a time of normal trade with Russia and satellite countries.

5. Any action of the kind discussed in the preceding paragraph would involve some element of open discrimination against the Soviet Union; it would invite retaliation in some form; and it would probably have serious political and economic consequences. Moreover, even if those consequences could be accepted, this type of action could not completely exclude the risk. For even, if it were possible by this type of action to keep all Russian, Polish and Roumanian ships away from the main target areas, the enemy could, if he were so minded, defeat all these precautions by chartering an innocent-looking ship of another flag and using it for a clandestine atomic attack or by placing his bomb in crated merchandise consigned to this country by a neutral vessel normally trading to a U.K. port.

Supervision of Diplomatic Freight

6. If the enemy wished to introduce an atomic bomb into this country in parts and assemble them here, as suggested in paragraph 2(ii) above, the parts would probably be consigned to the Soviet Embassy in London as diplomatic freight. A foreign Embassy has an absolute right to receive by diplomatic courier correspondence which is exempt from any examination by the territorial authorities. It has a further right to import certain things without paying Customs duty, but the territorial authorities are entitled to verify that diplomatic freight and diplomatic bags are not being abused as a method of importing things which are neither documents nor things which the Embassy has a right to import without paying Customs duty. It would therefore be permissible for us to open the Soviet diplomatic bag or to examine diplomatic freight for this purpose, provided that this were done in the presence of a member of the Soviet Embassy and that no attempt was made to open seals on any documents in envelopes. There would, however, be serious risks in doing so. We should invite immediate reprisals, which might involve widespread interference with our arrangements for supplying our own diplomatic missions behind the Iron

Curtain. In an exchange of discourtesies like this, we should normally have more to lose than to gain. Action of this kind could not fail to increase international tension. These disadvantages are certain. The gain, on the other hand, would be problematical; for we understand that, even if packages were opened and subjected to expert inspection, it could not be established with certainty that the contents were not parts of an atomic bomb.

7. Although it may be impracticable to prevent the importation of parts of an atomic bomb into this country, whether as diplomatic freight or otherwise, it is just possible that we might be able to detect the preparation for its assembly. This process would probably be directed and controlled through the Soviet Embassy in London, and it might be possible by increased vigilance to detect suspicious movements of vehicles to and from the Embassy. That is a point which we should like to examine further. It is of course by no means certain that we should be able by this means to secure, until it was too late, any positive indication that a bomb was being assembled here.

Conclusion

8. It is clear that it would be practicable for the Russians to introduce an atomic bomb into this country by clandestine methods. It is equally clear that there is no certain method of preventing them from doing so. The most that we could secure, by taking any of the measures discussed in this minute, would be to make their task more difficult. And the adoption of any of these measures would involve considerable risks and serious political and economic difficulties. This being so, it seems legitimate to ask whether the Russians would think it worth while to adopt these elaborate clandestine methods of launching an atomic attack when a military aircraft might do the job more effectively for them. An even larger question is whether the Russians would think it was worth their while to invite immediate retaliation by atomic attack against themselves so long as the advantage in numbers of atomic bombs remains overwhelmingly with the Americans.

9. The Chiefs of Staff have already arranged for an official working party (comprising representatives of the interested civil Departments) to consider means of guarding against this risk, and the possible

counter-measures discussed in this minute were all suggested in the report of this working party. The Chiefs of Staff have now asked me to arrange for further Departmental examination of these proposals and for any necessary submission to Ministers. For the reasons indicated in this minute I am very doubtful whether the increased security which might be obtained by adopting any of these measures could outweigh the very serious disadvantages, political and economic, which would be entailed. I have therefore thought it desirable to seek your guidance in the matter before asking Departments to undertake the work of assessing those disadvantages. You may like to discuss the problem with the Foreign Secretary and the Minister of Defence; but I suggest that, for the moment, it would be preferable that it should not be discussed in any wider group of Ministers.

(Signed) NORMAN BROOK

12th July, 1951

THE EFFECTS OF

HIGH-YIELD NUCLEAR EXPLOSIONS

Statement by

Lewis L. Strauss, Chairman

and

A Report by

The United States Atomic Energy Commission

February 1955

PROTECTION AGAINST FALLOUT

In an area of heavy fallout the greatest radiological hazard is that of exposure to *external* radiation, which can be greatly reduced by simple precautionary measures. Exposure can be reduced by taking shelter and by simple decontamination measures. Test data indicates that the radiation level, i. e., the rate of exposure, indoors on the first floor of an ordinary frame house in a fallout area would be about one-half the level out of doors. Even greater protection would be afforded by a brick or stone house. Taking shelter in the basement of an average residence would reduce the radiation level to about one-tenth that experienced out of doors. Shelter in an old-fashioned cyclone cellar, with a covering of earth three feet thick, would reduce the radiation level to about 1/5000, or down to a level completely safe, in even the most heavily contaminated area. Designs of shelters of simple yet effective construction have been prepared by the Civil Defense Administration and are available to the public.

Radioactive material deposited during the fallout may or may not be visible but would be revealed by radiation detection instruments such as Geiger counters. Any falling dust or ash that can be seen down-wind within a few hours after a nuclear explosion should be regarded as radioative until measured by a radiation detection instrument.

Care should be taken to avoid the use of solid foods or liquids that may contain fallout particles.

If fallout particles come into contact with the skin, hair, or clothing, prompt decontamination precautions such as have been outlined by the Federal Civil Defense Administration will greatly reduce the danger. These include such simple measures as *thorough bathing of exposed parts of the body and a change of clothing.*

INTERNAL RADIATION EFFECTS

Two other factors must be considered in evaluating possible hazards from radioactive fallout. The first is the effect of internal radiation from fallout particles swallowed in food or liquids. The second is the effect of radiation upon the germ cells which transmit inherited characteristics from one generation to another. It should be noted that in neither case is there reason to believe that weapons testing programs of the United States have resulted in any serious public hazard.

The radioactive forms of strontium and iodine are the constituents of fallout which are of principal concern as internal sources of radiation through ingestion. The concentrations of these substances from

STATEMENT BY LEWIS L. STRAUSS, CHAIRMAN UNITED STATES ATOMIC ENERGY COMMISSION

At a news conference on December 17, 1954, I stated that the staff of the Atomic Energy Commission was studying the subject of fallout and expressed the hope that information about it would be made public at a later date. "Fallout" is the word now applied to a phenomenon that follows the explosion of a nuclear weapon. Such an explosion, if the fireball touches the surface of the earth, draws up large amounts of materials into the bomb cloud. These materials subsequently fall back to earth as radioactive particles over a large area, mostly down-wind and relatively close to the point of explosion—although the lighter particles are carried great distances. The main radioactivity of fallout decreases very rapidly with time—for the most part, within the first hours after the explosion. An in-the-air explosion where the fireball does not touch the earth's surface does not produce any serious radiological fallout hazard.

Since nuclear weapons are in possession of the USSR, the Commission believes the American people wish to be informed regarding the dangers of nuclear explosions and the measures which individuals can take to protect themselves if an atomic attack should ever occur. Therefore, the Commission has condensed in the attached Report the information which can be made public at this time on the effects of the explosions of high-yield nuclear weapons.

The following excerpts and summarized sections contain the highlights of the Report itself.

FALLOUT PATTERN OF 1954 TEST IN THE PACIFIC

The very large thermonuclear device tested at Bikini Atoll on March 1, 1954, was detonated on a coral island and the ensuing fallout contaminated an elongated, cigar-shaped area extending approximately *220 statute miles down-wind and varying in width up to 40 miles.* In addition, there was a contaminated area up-wind and cross-wind extending possibly 20 miles from the point of detonation. Data was collected from 25 points on 5 atolls located from 10 to 330 miles down-wind (generally east) from Bikini Atoll. Due to an unexpected shift in the direction of the prevailing winds in the higher altitudes, the fallout missed the observation rafts that had been placed farther north

A REPORT BY THE UNITED STATES ATOMIC ENERGY COMMISSION ON THE EFFECTS OF HIGH-YIELD NUCLEAR EXPLOSIONS

1. Considerable information on the effects of the explosions of atomic weapons has been made public by the Government since the first nuclear detonations in 1945. The handbook, "The Effects of Atomic Weapons", published in 1950, is being revised and brought up to date to include the effects of thermonuclear weapons, as a result of the most recent tests at the Pacific Proving Grounds. References to the effects of thermonuclear explosions have been made in several official statements, beginning with Chairman Strauss' description of the phenomenon of "fallout" at a White House news conference on March 31, 1954. The following statement is designed to condense and correlate information, some of which already has been made public and other portions of which have been of a classified nature until now.

2. The effects of nuclear tests are evaluated for civil defense planning as well as for military and technological purposes. So long as nuclear weapons are in possession of any unfriendly power, the Commission believes the American public will wish to be as fully informed as possible as to the nature and extent of the dangers of nuclear attack and of the protective measures that can be taken by individuals and communities to avoid or minimize those dangers if we should be attacked.

3. Test conditions, which must necessarily form the principal basis of evaluating the effects of nuclear explosions, may differ markedly from those which might be expected if nuclear weapons were used against our population in wartime. It would be difficult to predict the size or kind of bomb an enemy might use against us in event of war, the exact means of its delivery, the height at which it would be exploded, or the number of bombs which might reach a given target. Nevertheless, the facts to follow are the fundamental ones at this time.

FOUR EFFECTS OF DETONATIONS

4. A nuclear detonation produces four major characteristics—blast, heat, immediate nuclear radiation, and residual radioactivity. Of these, the first three are essentially instantaneous, while the fourth has a more protracted effect. The phenomena of blast, heat, and nuclear radiation from the detonation of a thermonuclear bomb are

23. Thus, about 7,000 square miles of territory down-wind from the point of burst was so contaminated that survival *might* have depended upon prompt evacuation of the area or upon taking shelter and other protective measures.

24. At a distance of 220 miles or more down-wind, it is unlikely that any deaths would have occurred from radioactivity even if persons there had remained exposed up to 48 hours and had taken no safety measures.

25. The estimates cited above do not apply uniformly throughout the contaminated area inasmuch as the intensity of radioactivity within a region of heavy fallout will vary from point to point due to such factors as air currents, rain, snow, and other atmospheric conditions. Because of this and because most persons, if given sufficient warning, probably would evacuate the area or take shelter and other precautionary measures, the actual percentage of deaths could reasonably be presumed to be considerably *smaller* than these extreme estimates.

PROTECTION AGAINST FALLOUT

26. In an area of heavy fallout the greatest radiological hazard is that of exposure to *external* radiation. Simple precautionary measures can greatly reduce the hazard to life. Exposure can be reduced by taking shelter and by utilizing simple decontamination measures until such times as persons can leave the area. Test data indicate that the radiation level, i. e., the rate of exposure, indoors on the first floor of an ordinary frame house in a fallout area would be about one-half the level out of doors. Even greater protection would be afforded by a brick or stone house. Taking shelter in the basement of an average residence would reduce the radiation level to about one-tenth that experienced out of doors. Shelter in an old-fashioned cyclone cellar, with a covering of earth three feet thick, would reduce the radiation level to about 1/5000, or down to a level completely safe, in even the most heavily contaminated area. Designs of shelters of simple yet effective construction have been prepared by the Civil Defense Administration and are available to the public.

27. Radioactive material deposited during fallout may or may not be visible but would be revealed by radiation detection instruments such as Geiger counters. Any falling dust or ash that can be seen down-wind within a few hours after a nuclear explosion should be regarded as radioactive until measured by a radiation detection instrument and found to be harmless.

28. Care should be taken to avoid the use of solid foods or liquids that may contain fallout particles.

SUMMARY

42. The Atomic Energy Commission hopes that the information on nuclear weapons effects contained in the foregoing report will never be reflected in human experience as the result of war. However, until the possibility of an atomic attack is eliminated by a workable international plan for general disarmament, the study and evaluation of weapons effects and civil defense protection measures must be a necessary duty of our government.

43. Inevitably, a certain element of risk is involved in the testing of nuclear weapons, just as there is some risk in manufacturing conventional explosives or in transporting inflammable substances such as oil or gasoline on our streets and highways. The degree of risk must be balanced against the great importance of the test programs to the security of the nation and of the free world. However, the degree of hazard can be evaluated with considerable accuracy and test conditions can be controlled to hold it to a minimum. None of the extensive data collected from all tests shows that residual radioactivity is being concentrated in dangerous amounts anywhere in the world outside the testing areas.

44. In the event of war involving the use of atomic weapons, the fallout from large nuclear bombs exploded on or near the surface would create serious hazards to civilian populations in large areas outside the target zones. However, as mentioned in the foregoing Report, there are many simple and highly effective precautionary measures which must be taken by individuals to reduce casualties to a minimum outside the immediate area of complete or near-complete destruction by blast and heat. Many of these protective measures, such as shelter and decontamination procedures, have been detailed by the Federal Civil Defense Administration.

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ATOMS, NATURE, and MAN

Man-made Radioactivity in the Environment

by Neal O. Hines

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United States Atomic Energy Commission
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1966

Survival of an Animal Population

Engebi Island, on Eniwetok's northeast reef, is the home of a wholly self-contained colony of Pacific rats living in a network of burrows in the shallow coral sands. After 1948 Engebi was exposed repeatedly to atomic detonations, and in 1952 the whole island was swept clean of growth and overwashed by waves from the thermonuclear explosion of Operation Ivy. On each of these occasions, exposure of the rat colony to radiation was intense. In 1952, by later estimates, the animals aboveground received radiation doses of 2500 to 6000 roentgens per hour, and those in burrows doses of 112 to 1112 roentgens per hour. The island environment was so altered by atomic forces and by contaminated water that radiobiologists believed it impossible that any of the rats had survived. Because there was no natural route by which the island could be repopulated, scientists even considered introducing a new rat colony for study of a population growth in a mildly radioactive environment.


Engebi Island, Eniwetok Atoll, home of a colony of rats living in radioactive surroundings. Close- up shows one burrow in the soil.

Contrary to all expectations, however, the original colony had not been eliminated. Biologists visiting Engebi in 1953 and 1954 found the rats apparently flourishing. New generations of rats were being born and were subsisting on grasses and other plants in an environment still slightly radioactive. In 1955 analysis of the bones of rats revealed the presence of strontium-89 and strontium-90 in amounts that would not cause bodily harm. The rats' muscle tissues contained radioactive cesium-137. But no physical malformations were found in the rats. All animals appeared in sound physical condition, despite these body burdens of radioactivity. By 1964 the rat population had so increased that it apparently had reached equilibrium with available

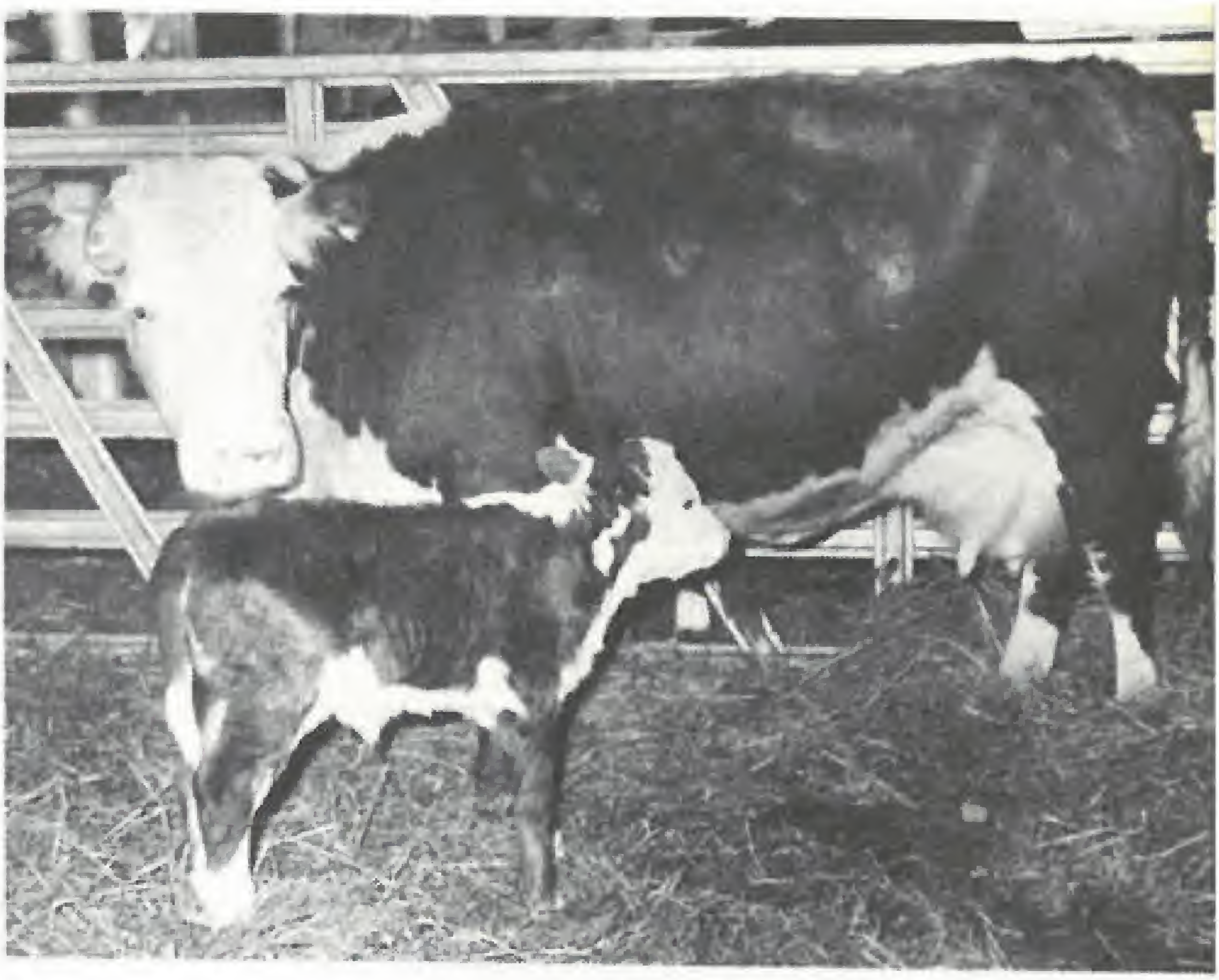
White-capped noddy tern nesting colony, Engebi Island, Eniwetok Atoll, photographed in 1965.

After 1951 each of the test programs had its radiobiological component. In the Pacific, radiobiological surveys were associated with Operation Ivy (1952), Operation Castle (1954), Operation Redwing (1956), and Operation Hardtack (1958). A small field station, the Eniwetok Marine Biology Laboratory, was established for use by scientists conducting biological studies. Bikini was incorporated into the Pacific Proving Ground in 1953, and new biological surveys were performed there in connection with the tests of 1954 and later.

A native rat, captured alive on Engebi Island

A thriving Messerschmidia *plant growing on Rongelap Atoll is studied for growth-rate and root-systems data after the island was accidentally subjected to radioactive fallout.*

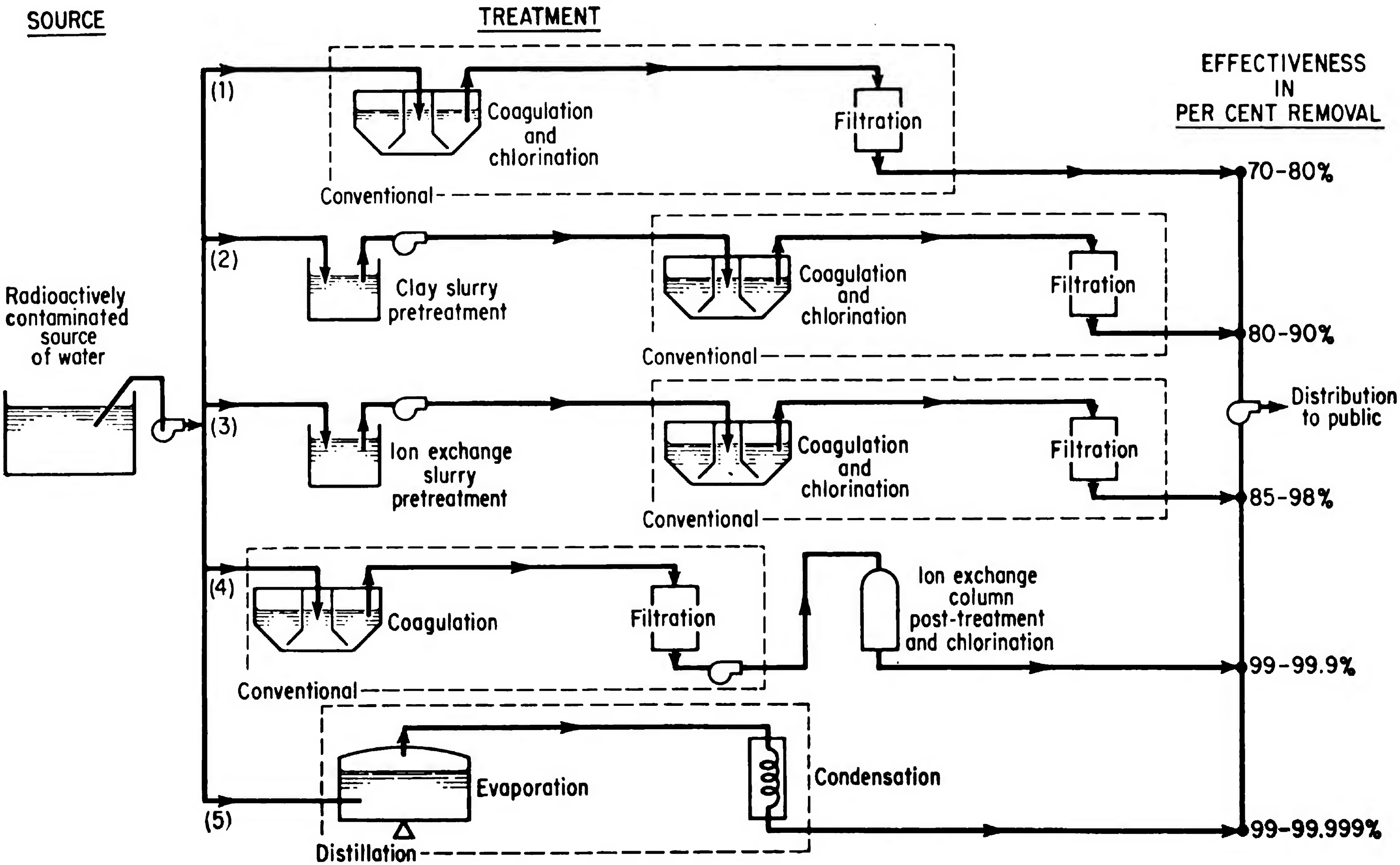
School of surgeonfish off Arji Island, Bikini Atoll, August 1964. Note coral growth on lagoon bottom.



One of the last cows of the herd exposed to fallout by the world's first atomic detonation in New Mexico in July 1945, photographed in 1964. The calf is her 15th to be born in 15 years. The cow, believed about 20 years old, has been under observation by scientists, who found she suffered little apparent effect, although the fallout caused some hair to turn gray (see light patches on back). Other cows in the herd died natural deaths.

THE AUTHOR

NEAL O. HINES is an established writer and experienced academic administrator with an unusual background in radiobiological surveys of the Pacific Ocean atomic test sites. He holds degrees from Indiana and Northwestern Universities. A former journalism teacher at the University of California and Assistant to the President of the University of Washington, Mr. Hines also worked for a number of years with the Laboratory of Radiation Biology of the University of Washington, where he served from 1961-1963 as administrative assistant and as Executive Secretary of the Advisory Council on Nuclear Energy and Radiation for the State of Washington. He was a member of the survey teams visiting Bikini and Eniwetok in 1949 and 1956 and Christmas Island in 1962. His "Bikini Report" (*Scientific Monthly*, February 1951) was one of the earliest descriptions of radiobiological studies in the Pacific. He is the author of *Proving Ground* (University of Washington Press, 1962), a detailed history of radiobiological studies in the Pacific from 1946-1961.



The decontaminating effectiveness of various water-treatment processes. (*Lacy & Stangler*, 1962.)

William J. Lacy & Marlow J. Stangler, "The Postattack Water-Contamination Problem", Health Physics, v8, issue 4, August 1962

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KEEPING THE PEACE

(DUTIES IN SUPPORT OF THE CIVIL POWER)

1957

This pamphlet supersedes Imperial Policing and Duties in Aid of the Civil Power, 1949 (WO Code No. 8439).

By Command of the Army Council,

E. W. Playfair

THE WAR OFFICE,
10*th April*, 1957.

RESTRICTED

The information given in this document is not to be communicated, either directly or indirectly, to the Press or to any person not authorized to receive it

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KEEPING THE PEACE

(DUTIES IN SUPPORT OF THE CIVIL POWER)

1957

PART I—GENERAL

CHAPTER I

INTRODUCTION

SECTION 1—GENERAL

1. Both at home and in the British dependencies overseas, British armed forces must always be ready to comply at once with any request from the civil authorities for assistance in maintaining peace or in restoring law and order. Also, during a state of emergency, they may be called upon to assist in maintaining public or other services essential to the life of a community.

2. The sole aim of military intervention to deal with general unrest is the restoration of law and order by military means when other methods have failed, or appear certain to fail. This aim must be clear in the minds of commanders at all levels and there must be a readiness to co-operate closely with the civil authorities and police. These are requirements of the first importance.

3. Once a request has been made for military assistance to restore law and order, the military commander, irrespective of his rank, is entirely responsible for the form which the action shall take. However, he should be guided by the advice of the civil authorities and police.

4. Disorders, especially in territories outside the United Kingdom, may take many forms. They can run the whole gamut from isolated local disturbances such as dock strikes, to large scale violence employing all the known techniques of subversion and even armed rebellion, aimed at overthrowing the established government.

5. Full scale revolts, although they do not occur frequently, generally break out on a scale likely to stretch any government's resources to the utmost and take a long time to bring under control. They may be largely indigenous in origin or they may be inspired from outside. But whatever their character, whether political, racial or religious, those who direct them lose no opportunity to stir up trouble by playing on the prejudices, fears and hopes of often unsophisticated people. They can cause prolonged outbreaks of violence and consequently create a problem of maintaining law and order to overcome which requires full scale counter-measures and the closest co-operation between the security forces and the civil authorities.

6. Recent experience overseas has revealed a fairly standard pattern for internal unrest of this kind as follows :—

Phase I. Terrorism to obtain the support of local personnel and access to material resources ; to frighten the local population out of giving information to the authorities ; to embarrass and cause disaffection among the forces of law and order (particularly those who are locally recruited) and to tie down security forces to static tasks.

Phase II. The creation of base areas under insurgent control (whether by propaganda, compulsion or terrorist methods), for purposes of food storage, concealment and recruitment.

Phase III. The complete control of large areas where an insurgent government can be proclaimed and where training and organization can proceed unhindered.

Phase IV. The complete overthrow of the established government.

7. To defeat this plan of unrest, the vital need is to prevent it ever getting beyond Phase I. This can only be done by having adequate police and military forces available to intervene promptly in support of the local government, so that it can react firmly to the threat to its existence. The police must be used on police tasks, such as obtaining information and providing static guards, while the military must be used for mobile operations which may vary from operations in thickly populated urban areas to hunts, covering large areas in jungle or mountain country, for terrorists.

8. In making his appreciation and in deciding his plan of military intervention in support of the civil power, a commander should be guided by the following principles :—

(*a*) *Necessity.*—There must be a necessity and justification for each separate act.

(*b*) *Prevention.*—This must be the reason for using military force; it must never be applied with punitive intent.

(*c*) *Minimum force.*—No more force must be used than is absolutely necessary to achieve the immediate aim.

(*d*) *Impartiality.*—Members of the armed forces must act impartially and calmly, and they must comply strictly with the law.

9. Finally, a commander must remember that when supporting the civil power his troops generally will be greatly outnumbered. The ability to counterbalance this disadvantage depends on good leadership, training, discipline and, in the last resort, skill in using weapons in such conditions as to produce exactly the effect which is needed.

10. The rules for the employment of troops in support of the civil power are given in the Manual of Military Law, Part II, Section 5. The legal aspects which are of vital importance are discussed in chapter 2 of this book.

25. Finally, when force is being used :—

(*a*) It must be applied in good faith, impartially and with preventive and not punitive intent.

(*b*) It must not be continued longer than is necessary to justify the immediate aim, i.e., the stopping of unlawful actions of offenders.

(*c*) A commander must not exceed his duty in one instance or at one place because it is his personal opinion that the effect will be beneficial in another instance or at another place.

SECTION 4—CIVIL DISTURBANCES

26. The types of disturbances in which troops may be called upon to intervene matter little and the principles set forth in the preceding paragraphs apply to each and every type. An explanation of the law relating to unlawful assemblies, riots and insurrections or rebellions will be useful to military commanders and is therefore given below.

Unlawful assemblies

27. An unlawful assembly is an assembly of three or more persons with intent either to commit a crime by open force or to carry out any common purpose (lawful or unlawful) in such a manner as to give firm and courageous persons in the neighbourhood of such assembly reasonable grounds to apprehend a breach of the peace in consequence of it. The commission of an act of violence by any one or more of those assembled is not necessary to make the assembly unlawful, if its character and circumstances are such as to be calculated to alarm not only foolish timid people but people of reasonable firmness and courage.

28. An unlawful assembly may be dispersed, although it has committed no act of violence. The civil authorities have power to command the persons forming it to go away, to arrest them if they do not go and to stop others whom they see joining them. If the civil authorities are resisted they may use such force as will compel obedience but it would be extremely inadvisable for them to use any such force as would maim or injure a person resisting, unless that person himself makes an attack inflicting, or calculated to inflict, grievous personal injury on his captor.

Riots

29. A riot is a tumultuous disturbance of the peace by three or more persons assembled together without lawful authority with an intent mutually to assist one another, by force if necessary, against any who should oppose them in the execution of some enterprise of a private nature and who afterwards actually begin to execute that enterprise in a violent and turbulent manner to the terror of other people. It is

and one cannot immediately be procured. A person lawfully making an arrest with or without a warrant may, without retreating, use such force as is necessary to overcome opposition and effect the arrest.

SECTION 6—STATE OF EMERGENCY

40. In the United Kingdom, colonies and protectorates, when an emergency arises which cannot be dealt with by the civil authorities under the ordinary law, even with the aid of military forces, emergency legislation is passed or brought into force giving the authorities special powers to deal with the emergency. Such special powers often enable the military authorities to exercise a greater degree of control than is normally the case. The civil administration, however, retains its independence but co-operates with the military commander in giving effect to the terms of this special legislation. Although such emergency legislation may tend to create dual responsibility between the civil and military authorities, this duality of responsibility is more theoretical than real and, as far as military authorities are concerned, any disadvantage is more than counterbalanced by the additional powers which the emergency legislation gives. Such emergency legislation cannot hope to provide in advance for all possible developments of the situation and if any additional powers are needed they must be asked for without delay. It is the responsibility of the military commander to make his requirements known to the local government in this respect.

SECTION 7—MARTIAL LAW

41. Military participation under emergency legislation does not constitute "martial law" and it is extremely unlikely that a proclamation of martial law will ever be made.

SECTION 8—REFERENCES IN MANUAL OF MILITARY LAW

42. The account of the law given in this chapter is sufficient for all practical purposes. However, when time permits, all officers will read the following :—

(*a*) Manual of Military Law, Part II, Sec. V (Employment of Troops in aid of the Civil Power).

(*b*) Manual of Military Law, 1956, Part I, Chapter 5, paras. 14 (Arrest), 17 (Self-Defence) and 18 (Protection of Persons and Property).

(*c*) Manual of Military Law, 1956, Part I, Chapter 1, paras. 10 to 13 (Martial Law and Emergency Legislation).

SECTION 9—CONCLUSION

43. Finally, it is again emphasized that a military commander should remember that **if the measures which he takes are, or he believes on reasonable grounds that they are, necessary to achieve his immediate object and he acts in good faith he need not fear the result of any inquiry into his conduct.**

CHAPTER 3

METHODS OF SUPPRESSING UNLAWFUL ASSEMBLIES AND RIOTS

SECTION 10—INTRODUCTION

44. This chapter explains in detail the action which should be taken by the armed forces when suppressing an unlawful assembly or a riot in the United Kingdom or in any other country where the English law (as explained in chapter 2) applies. In countries where the English law has been modified the instructions given in this chapter will have to be adapted to meet the requirements of the local law. It is essential therefore that all military commanders should acquaint themselves with local law.

45. If widespread disorders are expected, military intervention to deal with unlawful assemblies and riots needs to be pre-planned and rehearsed by the civil police and military authorities together. Outline plans should cover the following :—

(*a*) An assessment of the different types of disturbance likely to develop, their probable locations and strength and action needed to suppress them.

(*b*) An assessment of what troops will be required for each locality and the earmarking of a specific unit for each task.

(*c*) Arrangements for joint and discreet reconnaissances as necessary.

(*d*) The channels through which requests for military assistance will be made.

(*e*) Arrangements for establishing joint military/police operational headquarters.

(*f*) The preparation of any special stores likely to be needed, e.g., warning banners in appropriate languages.

(*g*) Training and rehearsal of all concerned, including the testing of communications and the procedure for handing over/taking over a riotous situation.

46. When armed forces are called upon to deal with an unlawful assembly or a riot it is highly desirable for each body of troops to be accompanied by a magistrate or his representative.

47. Military commanders must be prepared to intervene on their own authority if necessary (*see* chapter 2, para. 18).

48. Troops should be ready to intervene immediately on arrival at the scene of a disturbance, for if there is a delay it tends to allow a build up in front of them.

SECTION 11—DISPERSAL OF A CROWD

49. Once it is deemed necessary for armed forces to intervene, the military commander is entirely responsible for deciding what action is required by him to restore the situation. At the same time he should be guided by any advice given to him by the police or civil authorities.

50. If possible a commander will first try to disperse a crowd by non-violent means, e.g. :—

(*a*) Verbal and visual persuasion, using loudspeakers, banners and bugles, etc.

(*b*) The reading by a magistrate or other authorized civil authority of the proclamation under the Riot Act (*see* chapter 2, para. 30), or its equivalent abroad.

(*c*) Producing cameras to photograph ringleaders, agitators and others to enable them to be identified later as disturbers of the peace.

(*d*) The steady advance of a line of soldiers with fixed bayonets. However, this form of threat must only be used if the commander is quite certain in his own mind that there will be no danger of the troops coming into close contact with the crowd, as this will inevitably lead to hand-to-hand fighting, dispersion, loss of control and, perhaps, the use of more than minimum force by individual soldiers.

51. If all these methods are ineffective or impracticable, then more drastic action will have to be taken.

SECTION 12—OPENING FIRE

52. The responsibility for deciding to fire is solely that of the military commander on the spot. If possible he should consult with any representatives of the civil authorities present before ordering fire but he cannot ask them to take or share the responsibility for his actions.

53. When the military commander decides that fire must be resorted to in order to restore a situation, as far as possible the subsequent action will be as follows :—

(*a*) The crowd will be warned by all available means that effective fire will be opened unless it disperses at once.

(*b*) The order to fire will be given by the military commander himself to the fire unit commander(s) concerned. He will indicate the target and the number of rounds to be fired and ensure that only the minimum amount of force necessary is used.

CHAPTER 7

SECURITY FORCES

SECTION 33—THE PATTERN OF UNREST

131. Broadly speaking, there are three types of disturbances that may develop in a dependent territory :—

(*a*) *Civil disturbances* which are caused mainly by political, labour, religious and racial disputes leading to sporadic and isolated outbreaks of violence.

(*b*) *Civil insurrection* which may arise from any of the causes mentioned in (*a*) above, but which has a much greater degree of public support and is usually far more widespread. It may also arise out of attempts to hasten independence and self-government. The degree to which the objectives of dissident elements will command the sympathy of the established government will differ.

(*c*) *Cold war or general rebellion* which may be either communist-inspired or arise out of a local rebellion against British sovereignty or even westernization. Whichever form it takes, it makes use of local dissidents to fight the government with the aim of seizing power for its leaders. This type of rebellion does not really have the support of the majority of the population, but the leaders are able to terrorize a fair proportion either into taking an active part or at least acquiescing.

132. These conditions may occur singly or concurrently, and ultimately they may make necessary the intervention of security forces and the declaration of a state of emergency.

SECTION 34—HIGH COMMAND

133. The form of high command organization needed to deal with a state of emergency will depend on the type of constitution that exists in the country, the extent of the disturbance and the size of the available security forces.

134. The overall responsibility for restoring law and order rests fairly and squarely with the civil government, as long as one exists, but the necessary action needs to be initiated and conducted by the civil, police and military commanders together at all the appropriate levels. This can be done at the top level either by the appointment of a **director of operations** or by a form of **war council.**

171. Although the searching of individuals and property is primarily a police duty, on occasions it will have to be undertaken by soldiers who require training in the correct methods to be employed.

172. The importance of a high standard of turn-out and smartness needs to be emphasized constantly for civilians are very quick to notice such things and formulate their own opinion of the efficiency of military forces accordingly.

173. Physical fitness and the observance of rules of hygiene are normal requirements at all times, but they require emphasis when training troops for operations in a country subject to adverse climatic conditions.

Intercommunication

174. For internal security operations adequate communications are essential for the rapid passing of information. If they do not exist the necessary action by troops will be delayed and, consequently, it will be less effective. All operational lines of communication need to be duplicated as far as is practicable.

RADIO

175. Communications should be based on the wireless, since telephones will often be unreliable due to sabotage, tapping and adverse climatic conditions. If practicable, wireless should be supplemented by other methods such as visual telegraphy, an air despatch service and even carrier pigeons.

176. Commanders must be able to talk direct and without delay to their opposite numbers in the police and administration. Where police nets exist military formations and units should become outstations.

177. The use of despatch riders should be kept to the minimum, since they are easily ambushed. When used they must operate in pairs and, if possible, in vehicles as opposed to motor cycles.

SECTION 41—ANTI-TERRORIST OPERATIONS

Enemy characteristics

178. The majority of terrorists are members of the local population, who carry out acts of violence against both civilians and the armed forces on behalf of revolutionary organizations. Their fighting characteristics are as follows :—

(*a*) Terrorists may be both male and female, well armed with small arms and explosives, but lacking larger and more modern weapons.

(*b*) Terrorists are highly skilled at sabotage using time and home-made bombs, ambushes and hit and run attacks against military, police and civilians. They are also masters of fieldcraft with an intimate knowledge of the ground over which they operate. Initially they may be able to " demand " friendship everywhere.

(c) The chain of command of terrorists is difficult to penetrate or disrupt. It may be based on a "cell" system which stretches throughout the country, or it may have its roots, quite illegally, in a neighbouring border country. Some of the high commanders and others may be foreigners.

(d) Terrorists seldom have a recognizable administrative or intercommunication system.

179. When fighting, terrorists invariably use guerilla tactics. Their main efforts are made against easy targets, preferably against individuals, small parties and anyone who is defenceless or isolated. Their attacks are launched both in towns and in the open country. They seldom attack security forces, except on ground of their own choosing and when there is a chance of achieving surprise. As hunted men and women, terrorists soon become ruthless and cruel and they use extortion and force against defenceless persons to obtain anything they require.

Military tactics

180. In the early days of an emergency it may be necessary for security forces to become dispersed in a semi-static role to cover the expansion of the police, the creation of additional auxiliary forces, the time required for the passing of emergency legislation and the arrival of military reinforcements. But, as a permanent policy, dispersion relinquishes the initiative to the enemy, it is bad for morale and it will lead to ever-increasing terrorist activity. These tactics will never end an emergency.

181. The only effective course to adopt against terrorists is to concentrate against them with offensive action. Troops should be moved to areas where it is known that terrorists are operating, even if it is jungle or forest, and then the enemy must be located, engaged and finally destroyed.

182. Finally, there are three main ways in which terrorists can be brought to battle :—

(a) By luring into a trap or ambush.

(b) By sweeping an area.

(c) By patrolling.

Which of these courses, or combination of courses, is employed will depend on the nature of the country, forces available and information about the terrorists.

Some notes on the carrying out of these operations are given in Part III of this book.

CHAPTER 9

INTELLIGENCE

SECTION 44—INTRODUCTION

194. Intelligence is required on the broadest possible basis for the purposes of government and for the formulation of a government's political and security policies. It is required for the defence of a country against internal or external dangers arising from attempts at sabotage, espionage and from the activities of organizations and individuals who may be subversive to security. These are the permanent and standing requirements of any territory.

Tactical or operational intelligence is the intelligence required by security forces (civil and military) for purposes of taking action when disturbances have arisen.

195. Intelligence is the most important single factor in the prosecution of internal security operations. The terrorists' aim is to destroy the people's confidence in the ability of the government to protect them and, if successful, this results in members of the public refusing to come forward with information for fear of reprisals. In turn, this causes the drying up of intelligence sources of information. Without information, it is difficult to launch successful operations and without successful operations the confidence of the public cannot be restored. Therefore, from the onset, it is essential that early information is obtained about terrorist methods and habits without which security forces cannot train and operate successfully.

SECTION 45—ORGANIZATION

196. In a dependent territory the responsibility for the collection, collation and assessment of intelligence rests on the local government. It is the particular duty of the police and the Special Branch to collect information bearing on internal security, but the system is based on the direction of information from all sources (e.g., administrative officers, education and labour officers) into a single channel, with collation at all levels, leading to a central body whose duty is to produce a composite intelligence picture for the territory as a whole. This body usually takes the form of a local intelligence committee responsible to the governor. In most territories the governor also has the advice of a security liaison officer appointed by the UK Security Service who provides the link between the intelligence organization of the territory and the wider Commonwealth security network.

197. The chairman of the local intelligence committee is normally a senior administrative officer and sometimes he is designated the **director of intelligence.** Representatives of all the services and the

CHAPTER 10

THE WORD BATTLE

SECTION 48—PSYCHOLOGICAL WARFARE

218. It is the declared aim of HM Government that those people living under British rule will be guided along the road to self-government, and that the transfer of responsibility and power should be gradual in order to avoid detrimental consequences. When this aim is being imperilled by subversive propaganda and agitation, the counter balance must be provided by an efficient information service pursuing a sound, constructive and positive programme through the medium of newspapers, broadcasts, loudspeaker vans, etc.

219. If a situation deteriorates because of terrorist activities and a state of emergency has to be declared, there is need for a different type of information service, namely one which will carry out an offensive propaganda programme against the terrorist movement and act as a destructive force. Under such circumstances, it is necessary to apply the tactics of psychological warfare.

220. Psychological warfare is the planned use of psychological measures including information, propaganda, etc., designed to influence the opinions, emotions, attitude and behaviour of the enemy, neutral or friendly groups in support of current policy in time of war or emergency.

Tasks

221. The aim of psychological warfare under these conditions is as follows :—

(*a*) To undermine the confidence of terrorists in ultimate victory.

(*b*) To create confusion in the minds of terrorists about the righteousness of their policy, to weaken their will to fight and to cause distrust and dissension between leaders and men.

(*c*) To publicize the advantages and methods of surrender.

(*d*) To drive a wedge between dissident elements and the people, and to develop resistance to the political ideologies of their movements.

(*e*) To increase the confidence of the people in the government.

(*f*) To encourage active participation in the fight against terrorism on the side of the government.

(*g*) To make the righteousness of our aims clear to the people of the world.

222. Psychological warfare can be divided into three forms as under :—

(*a*) *Strategic.*—Strategic policy and action which need to be decided at the very highest level are part of the overall strategic plan. A continuous and relentless campaign must be aimed at the whole terrorist movement and the whole of the civil population.

(*b*) *Tactical.*—Tactical psychological warfare concerns the formation and regimental commander in the field more directly. Normally, it is aimed at a specific group of people or even an individual terrorist. It may be pre-planned in support of a single operation or it may have to be applied against an opportunity target which has suddenly presented itself. In the latter case, it requires prompt application.

(*c*) *Consolidation.*—Consolidation psychological warfare is directed entirely towards the civil population, to facilitate the organization of stable government, to gain the co-operation of the people and to counter enemy propaganda activities, thus securing lines of communications and assisting military operations.

Methods of application

223. Psychological warfare propaganda is applied by the following methods :—

(*a*) *The written word*—by means of leaflets, posters, pamphlets, books, special publications and the legitimate press.

(*b*) *The spoken word*—by means of radio, ground broadcasts, voice aircraft, surrendered personnel shock teams, films, discussion groups, public address systems and rumours.

224. The choice of media depends on their availability to the target audience and the standard of literacy and intelligence of the audience.

Effect

225. Psychological warfare deals with intangibles and therefore its effect is not always obvious. Immediate results are rare ; rather it is a relentless and remorseless campaign aimed at wearing down opponents. However, indirect results may be indicated by the external and internal propaganda of the subversive movement, the application of sanctions to prevent propaganda reaching their members and by promotions, demotions and executions.

226. The expert examination of captured documents and the interrogation of deserters are essential to psychological warfare operations to enable an analysis of results to be made.

Organization

227. Psychological warfare is an offensive weapon and its policy should be determined by the governor or war council responsible for the overall control of operations, but subject to direction from the United Kingdom on matters which may have external implications. Though many of the staff will be civilians, the responsibility for execution should rest with the director of operations or equivalent, working through a director of psychological warfare. The latter needs to have direct access to the governor or war council.

Finance

228. Psychological warfare cannot be run on the peacetime budget of the civil information service. Whether it is disseminated by leaflets, broadcasting or rumours it should be considered as ammunition and the cost calculated accordingly.

Conclusions

229. Psychological warfare is not an independent arm but an organic supporting weapon. The target is dictated by the current situation and the ammunition fashioned out of factual information. It cannot do miracles and it is not a substitute for action, or something to turn to when all else has failed.

230. Psychological warfare must operate inside the current operational plan and the overall strategy of the government, in support of its aims and objectives.

231. Psychological warfare is not deception. Moreover it must not be discredited. Its objectives can only be achieved by building up a reputation for credibility.

232. No subversive or terrorist movement can exist without support from the people. The support may be popular and voluntary or it may be involuntary through fear. Psychological warfare seeks to deny the movement that support which it requires, as well as to undermine terrorist morale.

SECTION 49—PRESS

233. A good public relations officer should be able to deal with most press matters on behalf of his commander. But, since the press dislike getting all their information second hand, it will be a great help if a commander can make himself available from time to time to talk to correspondents and, within reasonable limits, to be fairly accessible to them.

234. If press correspondents are forbidden to interview junior commanders and soldiers to obtain first hand stories, they may be justified in claiming that any errors in reporting were caused through

facilities and food distribution. If this happens, it will only result in driving neutrals into the enemy camp. It must be made clear to everyone, that any inconvenience and hardship caused to local inhabitants are not being inflicted with a punitive intent, but that they are a necessity to root out bad elements.

247. Military control over an area must not be continued a moment longer than necessary. As soon as there are indications of good behaviour and co-operation, the local inhabitants should be rewarded by the lifting of some of the restrictive measures. Later, a further reward can be the declaration of a " white area " with only limited control, and so on, until all restrictions can be withdrawn. This policy encourages good behaviour and acts as an incentive to other areas to drive out dissident elements and terrorists.

(Food control: Mau-Mau in Kenya; also Malaya)

SECTION 52—FOOD CONTROL

248. An effective method of waging war against guerilla terrorists is to introduce measures that aim to make it impossible for them to obtain food, medical supplies and other such items from local inhabitants. This can be done by reducing supplies to a bare minimum so that no one has any reserves available to give or sell to terrorists.

249. In order to deny food to terrorists, a system of control needs to be introduced, when legally permissible, by the following methods :—

(*a*) Crop growing restrictions.

(*b*) Supervision over and guarding of standing crops and stock.

(*c*) Control over harvests and food storage.

(*d*) Imposition of food rationing and the closing of trading centres.

(*e*) The prohibition of cultivation and cattle grazing adjacent to jungle or forests where terrorists are known to be located.

250. A combination of these restrictions may force terrorists to expose themselves more frequently in order to search for food, thus giving the security forces more chances of being able to bring them to battle. Also, they may force terrorists to divert manpower to undertake their own food cultivation.

251. The necessary action to control food supplies, etc., will be undertaken by the civil authorities in consultation with the military. Whenever possible, it should be civilian controlled with a specially appointed government official in charge. It requires careful planning, timing and co-ordination for, if imposed wrongly, it will cause hardship, create animosity towards the government and possibly international

CHAPTER 12

SEARCHING A BUILT-UP AREA OR VILLAGE

SECTION 53—ORGANIZATION

253. The large scale search of a built-up area or village is normally a combined police and military operation. If possible, it should be pre-planned in detail and rehearsed. In the event of the army having to undertake any form of search at short notice without police assistance, it should be conducted in the same way and the same principles should be observed, as far as they are applicable and practicable.

254. When undertaking a search everything possible must be done to maintain secrecy in order to achieve surprise. Reconnaissance of the area should be avoided and the information needed about the ground obtained from air photographs. For success, the plan needs to be simple and capable of rapid implementation. Methods and techniques also need to be constantly varied.

255. If sufficient troops and police are available the following parties should be organized for a search :—

(*a*) *Cordon troops.* Troops required to surround the area tc be searched to prevent anyone inside from getting out.

(*b*) *Outer cordon troops.* Troops required to be located some distance from the main cordon at strategic points, to prevent an attack or interference from outside the isolated area.

(*c*) *Search parties.* Parties of police and troops to undertake the search of houses and inhabitants in the isolated area.

(*d*) *Cage troops.* Troops required to erect and guard cages for holding persons awaiting interrogation.

(*e*) *Screening teams.* Parties of civil police to identify suspects and wanted persons.

(*f*) *Escort troops.* Parties of troops with transport to escort wanted persons to a place of detention after interrogation.

(*g*) *Road blocks.* Parties of troops/police on roads to stop traffic trying to enter the isolated area.

(*h*) *Reserve.* Troops required at all levels to deal with the unexpected. It may be necessary to use some of the reserves :—

(i) to enforce a curfew and operate loudspeakers ;

(ii) to maintain an OP on a building in order to observe rooftops ;

(iii) to watch the reactions of persons being searched (similar to the psychological approach used by customs officers).

CHAPTER 14

SECURITY DUTIES

SECTION 60—ROAD BLOCKS

297. During an emergency, it will be necessary to maintain a continuous check on road movement with the aim of catching wanted persons and preventing the smuggling of arms, etc. This requires the provision of road blocks, some of which may have to be manned by the military.

298. Since road blocks cause inconvenience and even fear, it is important that the local population is made to understand that they are entirely a preventive and not punitive measure, directed solely against bad elements and law breakers.

Types

299. Broadly speaking, there are two types of road blocks :—

(*a*) *Deliberate*

(i) Positioned in a town or in the open country often on a main road.
(ii) To act as a useful deterrent to unlawful movement.
(iii) Unlikely to achieve spectacular results.

(*b*) *Hasty*

(i) Similarly positioned in a town or in the open country, but the actual location often related to some item of intelligence.
(ii) Require quick planning and implementation.
(iii) Initially may achieve a quick success, but once position is known, tends to become a deliberate road block.

300. Concealment of a road block is desirable, but often impossible, especially in a built up area. However, it should be located where it is at least difficult for a guilty person to turn back or reverse a vehicle without being noticed. Round a sharp bend or in a dip are good positions.

301. A road block must have adequate troops to make it secure, because it is a good target for a terrorist ambush. (Truck bombs)

302. A road block is best established by placing two parallel lines of knife rests (each with a gap) across the road, approximately 50 yards apart. The enclosure formed can then be used as the search area.

303. If possible, there should be a place in the search area where large vehicles can be examined without delaying the flow of other traffic which can be dealt with quickly. Since a road block must

Equipment

338. Certain additional equipment and weapons are required to enable the soldier to carry out the police role :—

(a) *Tear smoke.*—Tear smoke may be available, but it must be used with care as it is a double-edged weapon, in that much fatigue is caused to our own forces due to the necessity of having to wear respirators. The tendency to use tear smoke as the immediate solution to every situation must be resisted. The 91 grenade and riot gun have given the army the means of using tear smoke as a supporting weapon.

(b) *Batons.*—Baton sections will need to be equipped with batons, wooden or wire shields and visors if available. Shields should be secured to the forearm. Batons should be wielded with a lateral crossing movement aimed at the arms of a rioter, not his head. Baton parties should not wear web equipment or any article which gives a rioter an easy hand-hold.

(c) *Dye sprayers.*—Improvised dye sprayers may be available. If unwieldy, they are best carried on the seat of a ¼-ton truck, and operated by the passenger alongside the driver. The requirement is for a dye sprayer with a maximum range of 50 yards.

Training

339. It is essential that the police and army train together in anti-riot drill until they are thoroughly conversant with it. The drill needs to be simple and one that can be readily adapted to meet changing circumstances. It is essential that it is flexible. Probably the best method of ensuring that the riot striking force is properly organized and ready to do its task is for the military and police elements to train together regularly to practise forming up quickly, embussing, debussing and collective action under varying conditions.

Conclusion

340. It will be found that the soldier takes readily to this new role, mixes extremely well with the police and proves himself to be resolute and fully capable of dealing with unlawful assemblies and rioting by using police methods. But soldiers must not be left long in a police role for it puts an extra strain on administration and seriously reduces training for war.

CHAPTER 16

AMBUSHES, SWEEPS AND PATROLS

SECTION 64—THE TERRORIST AMBUSH

Enemy tactics

342. During a state of emergency, troops and vehicles of the security forces are likely to be subjected to terrorist ambushes, both in towns and outside, when carrying out their day to day duties. Therefore measures are needed to turn these ambushes into an opportunity to kill the enemy, as well as to reduce their effect to the minimum.

343. The aim of terrorists when conducting an ambush is to inflict casualties and if possible to capture arms and ammunition. An ambush is likely to have the following characteristics :—

(*a*) It is laid in a place where a target can be expected to appear within a fairly short time. The position chosen may be where vehicles tend to have to slow down, halt or become closed up, or where troops on foot have difficulty in moving over the ground.

(*b*) Outside a town or village, an ambush is likely to be conducted in close country from one or both sides of a road or track, up to a distance of 400 yards. In a town or village, it is likely to be made from or near buildings, particularly those that flank a narrow street. In both cases, the site chosen is certain to have good lines of withdrawal for the enemy.

(*c*) When conducting an ambush outside a town or village, terrorists often divide themselves into a firing group to kill, a charging group to finish off survivors and a capturing group to seize arms and equipment. In a built up area, an ambush is more likely to be made by one or two persons only, who strike and then disappear immediately.

(*d*) Fire is likely to come from rifles, automatic weapons and grenades. Mines and fallen trees may be used to block a route. In towns and villages, grenades are often thrown from a window or from behind a wall.

(*e*) A minor incident (not necessarily violent) may be created to try and draw troops into a killing ground where an ambush has been laid.

(*f*) Terrorists tend to conduct ambushes outside towns more often in daylight than in darkness, and particularly during the last few hours of daylight. In towns and villages, they may occur at any time.

authority and if they suffer any injury it may have repercussions of great magnitude. Furthermore, success by terrorists against a VIP will have tremendous propaganda value for their cause and enable them to claim a decisive victory over the security forces whom they are fighting.

354. Basically the measures to be taken to guard a VIP are those already described above, with the addition of the following points :—

(*a*) The strength of the escort required will depend on circumstances, but a convenient size is one platoon.

(*b*) There should be an armoured vehicle available in which the VIP can travel during any part of the journey when an attack is to be expected. At other times, the plan should make it possible for the VIP to travel in a more comfortable vehicle.

(*c*) Throughout the move, the vehicle carrying the VIP must be closely supported by a second vehicle carrying at least one automatic weapon and " bodyguard " troops. If possible this vehicle should be armoured.

(*d*) The vehicle carrying the VIP should not bear any special distinguishing marks.

(*e*) In the event of an attack, it is the duty of the " bodyguard " troops to protect the VIP, and to get his vehicle out of the danger area as quickly as possible.

(*f*) It may be desirable to provide air cover for the party, to make dummy and live runs along the route against possible ambush positions.

(*g*) The escort must have adequate wireless communications.

(*h*) Secrecy about the details of the move must be maintained as long as possible.

355. Before starting the move, the nominated escort commander should report to and brief the VIP as to what action he wishes him to take in the event of attack. Thereafter, the VIP will expect complete command to be exercised by the escort commander, even though he himself may be a senior service officer.

SECTION 65—THE ANTI-TERRORIST AMBUSH

356. The aim of an ambush laid by our own troops is to kill terrorists on ground of our own choosing. It may be laid as a result of information, suspicion or part of the overall plan.

357. To achieve success, spontaneous co-ordinated action on a surprised enemy held within a prepared killing area is needed. This requires :—

(*a*) Careful planning and briefing.

(*b*) First class security at all stages.

(*c*) Concealment of all signs of the approach and occupation of the position.
(*d*) Intelligent layout and siting.
(*e*) Rigid control throughout the operation.
(*f*) Rehearsals of action needed on the approach of an enemy.

Planning

358. Good ambush areas are a bend in a track or road, a clearing, a water hole, a defile or a water crossing. Information about suitable locations can be obtained from police, maps, air photographs and previous patrol reports. When choosing, obvious places are not always the best and cunning is needed.

359. All members of the ambush party must be fully briefed. A sound plan is to hold a preliminary briefing before departure, followed by a final briefing in the ambush area after the commander has been able to see the actual ground.

Layout

360. An ambush can be located on one or both sides of the selected killing ground, though in the latter case there is always a danger of two parties firing at each other. Normally, it is best to occupy only one side of the chosen killing area and seal the other with booby traps, wire and other obstacles.

361. When siting an ambush position the following principles need to be observed :—
(*a*) The killing ground can be covered by fire with the available weapons and once the enemy is inside he cannot easily escape.
(*b*) There are good fire positions with cover for our own troops.
(*c*) There are positions where look-outs can be posted and for any necessary administrative area.

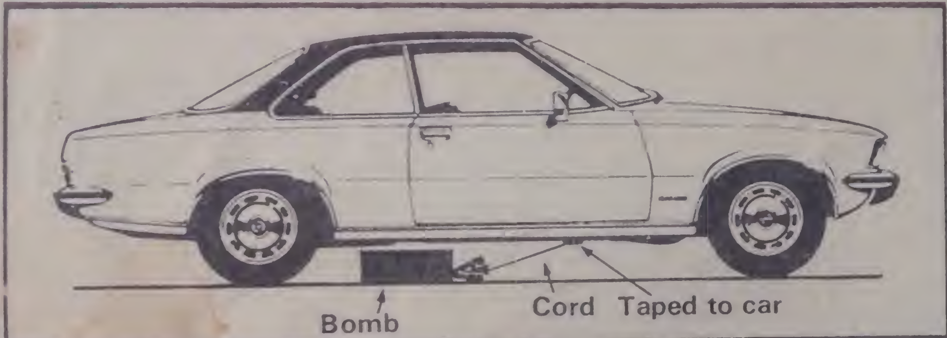
Occupation and waiting

362. An ambush should be occupied from the rear. All routes used must be carefully concealed.

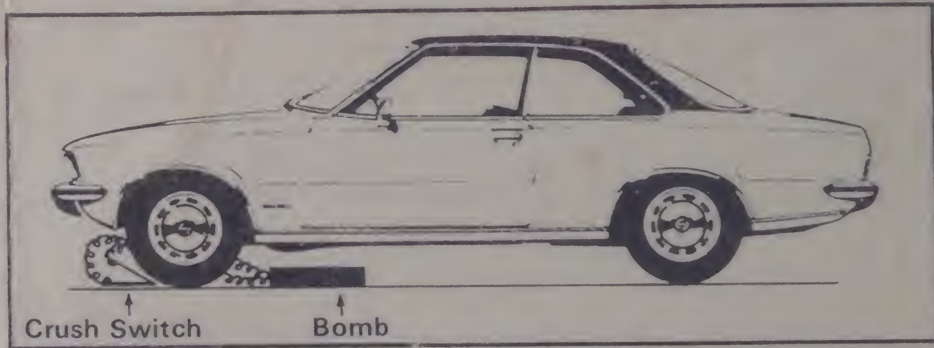
363. Weapons must be positioned so that they can bring point blank fire to bear. It may be possible to place some weapons in concealed positions in trees.

364. If an ambush is to be maintained for a long period, it may be possible for it to be manned initially only with look-outs, with the remaining men in an administrative rest area ready to come forward the moment anyone is seen or heard approaching. In these circumstances, concealed approach lanes connecting the administrative area with the ambush position will be required and a system of silent signals.

BEWARE OF BOOBY TRAPPED CARS



ON 17 MAY 1973 IN OMAGH A BOOBY TRAP OF THIS TYPE KILLED 5 SENIOR ARMY NCO'S



ON 12 DECEMBER 1973 IN NEWCASTLE A BOOBY TRAP OF THIS TYPE KILLED AN RUC CONSTABLE

IT COULD TAKE LESS THAN 5 MINUTES TO TURN A CAR INTO A BOMB - DON'T LET THE BOMBER GET AT YOURS.

ALWAYS PARK YOUR CAR IN A SECURE PLACE

IF THIS IS NOT POSSIBLE AND YOU MUST LEAVE IT UNATTENDED, THESE PRECAUTIONS MAY PREVENT YOUR DEATH

INTO A BOMB - DON'T LET THE BOMBER GET AT YOURS.

ALWAYS PARK YOUR CAR IN A SECURE PLACE

IF THIS IS NOT POSSIBLE AND YOU MUST LEAVE IT UNATTENDED, THESE PRECAUTIONS MAY PREVENT YOUR DEATH

BEFORE LEAVING YOUR CAR

USE 'TELL TALES' TO INDICATE ANY INTERFERENCE—COTTON THREADS SECURED WITH SELLOTAPE ACROSS THE BONNET, DOORS AND BOOT WILL BE BROKEN IF ANYONE OPENS THE CAR.

'TELL TALE' OBJECTS SUCH AS MAGAZINES OR COATS PLACED ON THE SEATS MAY INDICATE IF THE INSIDE OF THE CAR HAS BEEN DISTURBED.

ON RETURNING TO YOUR CAR

BEFORE TOUCHING ANYTHING CHECK THE OUTSIDE OF THE CAR, PARTICULARLY YOUR 'TELL TALES', FOR SIGNS OF TAMPERING.

EXAMINE UNDERNEATH THE CAR FOR ANYTHING ON THE GROUND OR ATTACHED TO THE CHASSIS

IF YOU ARE IN ANY WAY SUSPICIOUS TELL THE NEAREST ARMY POST, POLICE STATION OR

DIAL 999

Issued by HQ Northern Ireland

Credit: Daily Express

Crimea, 3 March 2014

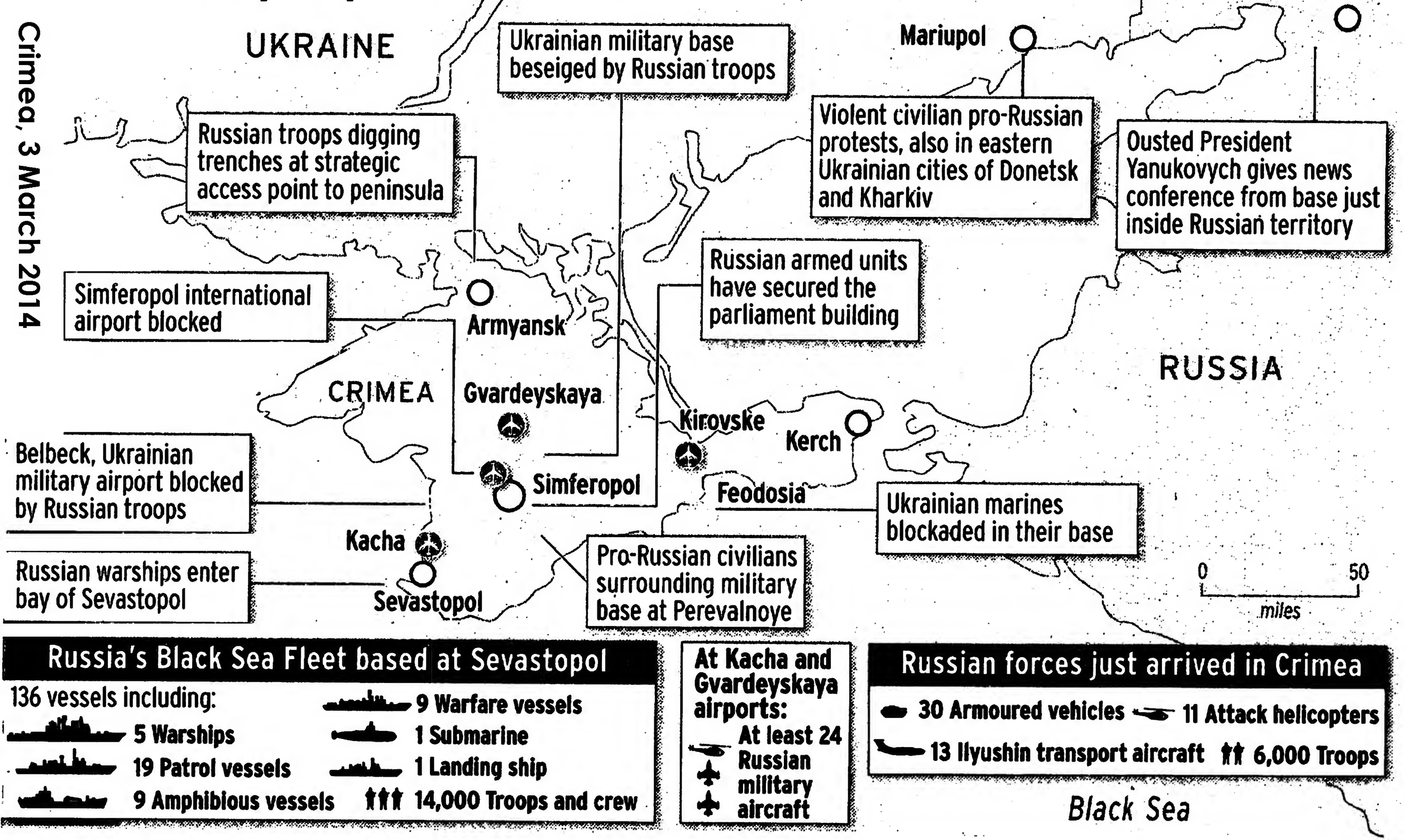


TABLE 14

The mechanics of intervention of the loyalist forces

Phase	Effect of our general measures
1. Police/security agency personnel raise initial alarm and seek to contact their HQ.	Telephone exchange has been seized, telex cable links have been sabotaged, radio relays are shut off. They must therefore send a verbal message.
2. Police/security agency HQ verify the reports and realize the seriousness of the threat. HQ tries to communicate with political leadership.	As above for communications. Some messengers fail to arrive as focal traffic points are gradually occupied.
3. Political leadership calls for army and police intervention.	As above for communications. Some units missing from their barracks; others refuse to move; others cannot move because of technical neutralization.
4. Political leaders begin to realize the extent of our infiltration of the armed forces and police. Loyalist troops respond.	As above for communications. Only military radio links can be used to communicate with loyalist forces.
5. Uninfiltrated forces assemble and prepare for intervention. They try to reach political leadership for a confirmation of their orders. Some defect to us, others choose neutrality, but some remain under the control of the government.	Many political leaders no longer available; some arrested and some in hiding.
6. Loyalist forces move on to capital city, or if already within its area move into the city center.	Airports closed and landing strips interdicted. Railways interrupted and trains stopped. City entry points controlled by our roadblocks.

Loyalist forces in capital city area are then isolated by direct means.

Fig. 6 OPERATIONAL SEQUENCE AND TIMING

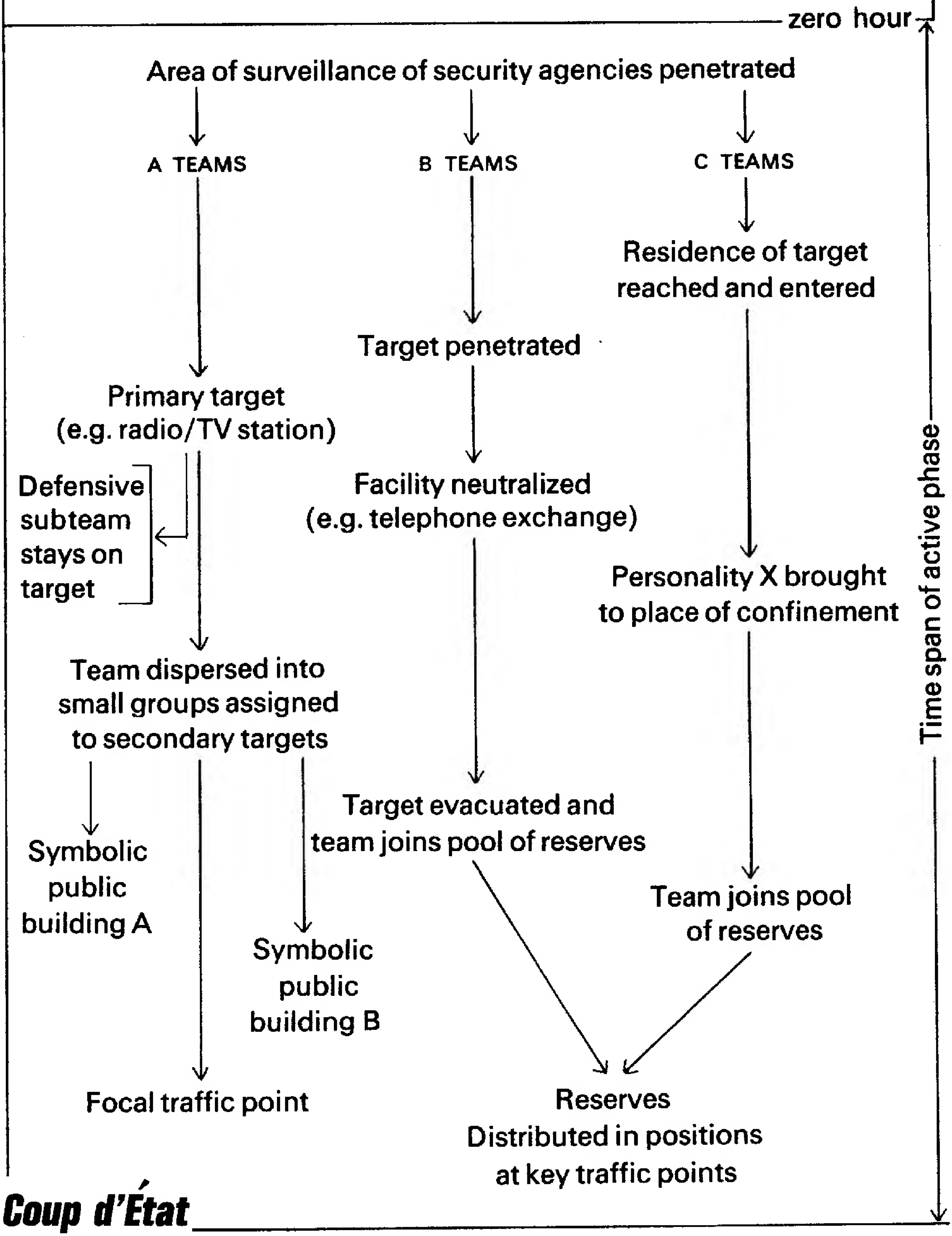
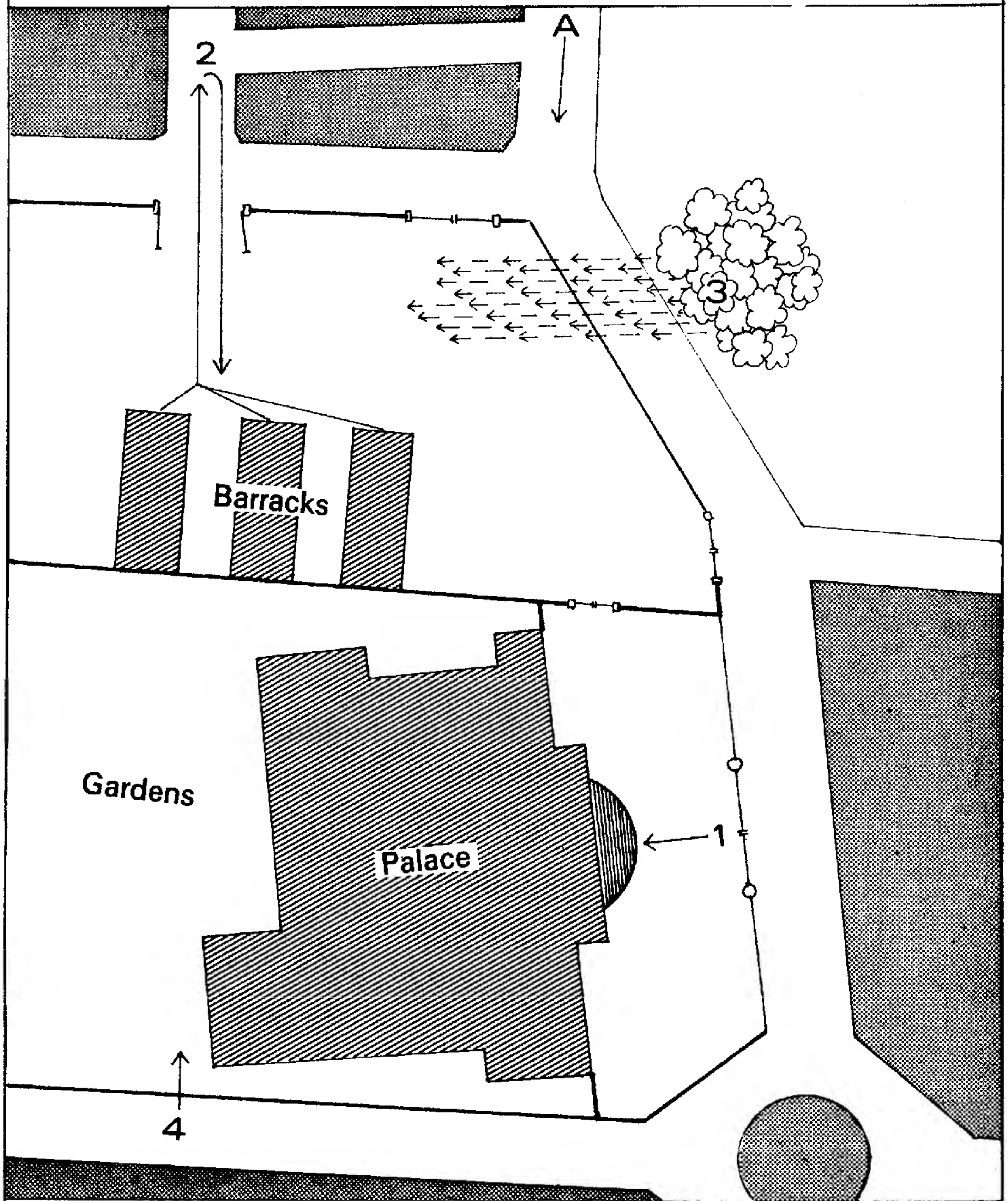


Fig. 12 "SOPHISTICATED" SEIZURE OF MAJOR DEFENDED TARGETS



SEQUENCE

1. Civilian penetration
2. Diversion designed to attract loyalist troops away from palace
3. Interdicting fire to prevent their return and the passage of the main loyalist forces
4. Assault group from street enters into action

A. Expected approach of main loyalist forces

~~Strictly Confidential~~

Memorandum on the properties of a radioactive "super-bomb".

The attached detailed report concerns the possibility of constructing a "super-bomb" which utilizes the energy stored in atomic nuclei as a source of energy. The energy liberated in the explosion of such a super-bomb is about the same as that produced by the explosion of 1000 tons of dynamite. This energy is liberated in a small volume, in which it will, for an instant, produce a temperature comparable to that in the interior of the sun. The blast from such an explosion would destroy life in a wide area. The size of this area is difficult to estimate, but it will probably cover the centre of a big city.

In addition, some part of the energy set free by the bomb goes to produce radioactive substances, and these will emit very powerful and dangerous radiations. The effect of these radiations is greatest immediately after the explosion, but it decays only gradually and even for days after the explosion any person entering the affected area will be killed.

Some of this radioactivity will be carried along with the wind and will spread the contamination; several miles downwind this may kill people.

The mechanism which brings the parts of the bomb together must be arranged to work fairly rapidly because of the possibility of the bomb exploding when the critical conditions have just only been reached. In this case the explosion will be far less powerful. It is never possible to exclude this altogether, but one can easily ensure that only, say, one bomb out of 100 will fail in this way, and since in any case the explosion is strong enough to destroy the bomb itself, this point is not serious.

As regards the reliability of the conclusions outlined above, it may be said that they are not based on direct experiments, since nobody has ever yet built a super-bomb, but they are mostly based on facts which, by recent research in nuclear physics, have been very safely established. The only uncertainty concerns the critical size for the bomb. We are fairly confident that the critical size is roughly a pound or so, but for this estimate we have to rely on certain theoretical ideas which have not been positively confirmed. If the critical size were appreciably larger than we believe it to be, the technical difficulties in the way of constructing the bomb would be enhanced. The point can be definitely settled as soon as a small amount of uranium has been separated, and we think that in view of the importance of the matter immediate steps should be taken to reach at least this stage; meanwhile it is also possible to carry out certain experiments which, while they cannot settle the question with absolute finality, could, if their result were positive, give strong support to our conclusions.

O. R. Frisch
R. Peierls

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Birmingham.